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Physical Property Standards

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Standard Reference Materials®
Catalog
1998–99

NIST Special Publication 260

Nancy M. Trahey, Editor
Ilse E. Putman, Electronic Composition

Standard Reference Materials Program
Office of Measurement Services
Technology Services
National Institute of Standards and Technology
Gaithersburg, MD 20899-0001

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Foreword

Historically, Standard Reference Materials (SRMs) have been used as vehicles for transferring National Institute of Standards and Technology (formerly National Bureau of Standards) measurement science and technology through channels of industry and commerce, to the country at large. Each new SRM is the result of collaboration between NIST and representatives of science and industry. SRMs are crucial reference points in establishing a comprehensive measurement system for the whole nation. Such a system, which has incrementally improved throughout the years, has met the needs of U.S. industry and commerce for nearly 100 years and continues to evolve as it is called upon to meet more increasing demands in measurements. The fast pace of technological change, coupled with increased demands on quality, traceability and SRM types, are making the perpetuation of the existing system into the future a very challenging proposition.

We must take advantage of new quality management concepts and scientific and technological opportunities which will lead to improvements in the transfer of NIST technology through SRMs. The SRM Program increasingly is using collaborations with industry that will enable NIST to expand the coverage of measurement needs by providing more new reference materials which have been coupled to a strategy of benchmarking a particular measurement system with fewer SRMs. Consequently, NIST will only renew existing SRMs that have been strategically planned and justified. This will allow NIST resources to be more effectively directed to measurement areas of anticipated high economic need or impact.

The SRMs available in this new 1998-99 catalog are reflections of some of the above strategies as well as our efforts to fill needs as rapidly as they can be identified. Increasingly, science and industry are calling for more units of existing SRMs for expanding fields such as optical radiation measurements, telecommunications, aerospace industries, and national problems such as air and water pollution, and health. This catalog contains new SRMs in all of these areas.

The Program's emphasis will continue to be on providing NIST SRMs —

- where attainment of needed measurement accuracy is not economically or technically feasible elsewhere,
- where industry-wide standards for commerce are needed from a neutral supplier not otherwise available,
- where continuing availability of a highly characterized material from a common source is important to science or industry.

The SRM Program invites you to review the 1998-99 catalog edition to see if any of the available SRMs can be of use to your measurement system. Also, take a moment to provide feedback to me as to your measurements and reference materials needs.

Thomas Earl Gills, Chief
Standard Reference Materials Program
National Institute of Standards and Technology
E-Mail: thomas.gills@nist.gov

NIST SRM Program

Mission — to provide reference materials that are the definitive physical sources of measurement traceability in the United States. The Program promotes and supports the development and certification of NIST SRMs essential to industry, academia, and government in order to facilitate commerce and trade and to advance science and technology.

Vision — to provide and support NIST customers with affordable and readily available reference materials of the highest quality and metrological value.

Contents

Abstract and Key Words

This catalog provides technical and general ordering information for the Standard Reference Materials (SRMs) and Reference Materials (RMs) currently available from the National Institute of Standards and Technology (NIST) Standard Reference Materials (SRM) Program. The materials are arranged according to technical category and classified as follows:

- Standard Reference Materials for Chemical Composition;
- Standard Reference Materials for Physical Properties;
- Standard Reference Materials for Engineering Materials.

Technical descriptions are given for all materials and may include certified values. However, these values are incomplete as they appear in the catalog and therefore cannot be referenced for actual measurement purposes. The certificates issued by the SRM Program are the only legitimate sources of certified information for NIST reference materials.

Key Words: analysis, calibration, certified reference material (CRM), characterization, composition, concentration, material, measurement, property, quality assurance, quality control, reference material (RM), Standard Reference Material (SRM), standardization, traceability.

NIST Terminology and Logo

The terms "Standard Reference Material" and "SRM", and the logo " 

", are Federally registered trademarks of the National Institute of Standards and Technology (NIST) and the U.S. Government, who retain exclusive rights to them. Permission to use the terms and/or logo is controlled by NIST as is the quality of the use of the terms and of the logo itself.

NIST Policy Regarding Use of Metric (SI) Units

The following policy was established in February 1991:

> In accordance with the Metric Conversion Act of 1975 as amended by Section 5164 of the Omnibus Trade and Competitiveness Act of 1988 and as required by related provisions of the Code of Federal Regulations, *the National Institute of Standards and Technology (NIST) will use the modern metric system of measurement units (International System of Units — SI) in all publications.* When the field of application or the special needs of users of NIST publications require the use of non-SI units, the values of quantities will be first stated in SI units and the corresponding values expressed in non-SI units will follow in parentheses.

The technical information contained in this catalog is consistent with the above policy. Only SI units and symbols have been used to describe the reference materials contained herein. Therefore, abrogated or obsolete quantifiers (e.g., the term, ppm), no longer appear, but rather have been replaced with the correct SI term, (mg/kg), and reference material values previously expressed in only in-lb units, have been converted to the appropriate SI units [1,2]. Due to space limitations, the non-SI units converted are not shown in the catalog.

In accordance with the above policy, this edition of the catalog no longer references the abrogated quantifier, "Wt. %." This quantifier has been replaced with the appropriate SI quantifiers, such as "mass fraction, in %", "amount-of-substance fraction, in %", or "mole fraction, in %." The exclusive use of SI quantifiers for expressing NIST SRM and RM certified, reference, and information values was instituted by the SRM Program and the NIST technical divisions in 1995 and apply to all SRM certificates and RM Reports of Investigation issued since that time. However, the certificates for SRMs issued before 1995 still show certified values expressed in "Wt. %." These certificates will not be revised. Rather, the appropriate SI quantifiers will be referenced when new certificates are generated for future renewal issues of these SRMs.

Note to SRM Users: *Individual SRM certificates should be consulted to ascertain if certification data have been expressed in both SI and non-SI units.*

[1] The International System of Units (SI), NIST Special Publication 811, 1994 Edition.

[2] ANSI/IEEE/ASTM SI 10 Use of the International System of Units (SI) — The Modern Metric System, April 1997. (Available from IEEE or ASTM.)

NIST Policy On Measurement Uncertainty Statements

The following policy was established in January 1993:

> [ ] . . . . . All NIST measurement results are to be accompanied by quantitative statements of uncertainty [1]. To ensure that such statements are consistent with each other and with present international practice, this NIST policy adopts in substance the approach to expressing measurement uncertainty recommended by the International Committee for Weights and Measures (CIPM).

[The CIPM approach is based on Recommendation INC-1 (1980) of the Working Group on the Statements of Uncertainties. More recently, at the request of the CIPM, a joint BIPM/IEC/ISO/OIML working group developed a comprehensive reference document on the general application of the CIPM approach [2]. The development of this document is providing further impetus to the worldwide adoption of the CIPM approach.]

The uncertainty statements contained in certificates for SRMs produced after January 1993 are in compliance with the above policy. To the fullest extent possible, these certificates describe the uncertainty components associated with each certified value reported, in terms recommended by the CIPM approach. The NIST technical division(s) that approved the certification protocol, produced the SRM, and evaluated the certified value(s) and associated uncertainty(ies) resulting therein, are responsible for employing the statistical methods that are in accordance with this policy.

Note to SRM Users: *It is essential that all statistical information contained in a NIST SRM certificate be carefully reviewed before the certified value(s) and associated uncertainty(ies) are applied to a measurement process or program.*

---

[1] Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results, NIST Technical Note 1297, 1994 Edition.

[2] Guide to the Expression of Uncertainty of Measurement; First edition 1993; ISBN 92-67-10188-9; International Organization for Standardization (ISO), 1993.

Program Information

Through the SRM Program, NIST provides more than 1200 different SRMs that are certified for their specific chemical or physical properties. SRMs are used for three main purposes: to help develop accurate methods of analysis (reference methods); to calibrate measurement systems; and to assure the long-term adequacy and integrity of measurement quality assurance programs. NIST SRMs also constitute part of the National Measurement System infrastructure of the United States and, as such, are essential transfer mechanisms for national and international measurement traceability.

The SRM Program itself is the central point at NIST for coordination of all reference materials services and related activities. In this capacity, the Program 1) performs continuous analysis and needs assessment of national reference materials and requirements 2) establishes and promotes uniform criteria for the development and certification of reference materials, 3) performs technical activities related to the preparation, packaging, and distribution of SRMs, 4) prepares and updates the SP 260 Standard Reference Materials Catalog and its price list supplement, 5) publishes and issues a variety of other documents and articles such as journal articles, brochures, and newsletters, 6) provides independent review of the SRM value assignment process, 7) establishes jointly with NIST technical divisions, vertical traceability links with the U.S. secondary reference materials producers, 8) provides customer support to purchasers and users of SRMs, 9) provides official NIST representation on national and international standards committees, 10) coordinates international activities involving reference materials intercomparisons and collaborative efforts to demonstrate reference material compatibility.

The SRM Program sponsors a series of publications, known as the SP 260 series, that is available to assist users in the application of SRMs. Some of these publications give practical guidance for using SRMs while others give additional information about the certification process of specific SRMs. Of special note is NIST Special Publication 260-100, Standard Reference Materials Handbook for SRM Users, by John K. Taylor, that was written to present general concepts of precision and accuracy as applied to SRMs and to discuss their impact on quality assurance and measurement processes.

Definitions

The SRM Program references a number of definitions in connection with the production, certification, and use of its SRMs and RMs. Certain definitions, adopted for SRM use, are derived from international guides and standards on reference materials and measurements while others have been developed by the SRM Program to describe those activities unique to NIST operations. A listing of NIST-adopted and NIST-developed definitions follows.

Accuracy — (1) The closeness of agreement between a test result and the accepted reference value. [*ISO 5725-1*] (2) Closeness of the agreement between the result of a measurement and a true value of the measurand. "Accuracy" is a qualitative concept. [*VIM:1993*]

Certified reference material — Reference material, accompanied by a certificate, one or more of whose property values are certified by a procedure which establishes its traceability to an accurate realization of the unit in which the property values are expressed, and for which each certified value is accompanied by an uncertainty at a stated level of confidence. [*ISO Guide 30:1992*]

Reference material — Material or substance one or more of whose property values are sufficiently homogeneous, stable, and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. [*ISO Guide 30:1992*]

Reference material certificate — Document accompanying a certified reference material stating one or more property values and their uncertainties, and confirming that the necessary procedures have been carried out to ensure their validity and traceability. [*ISO Guide 30:1992*]

Uncertainty of a certified value — (1) Estimate attached to a certified value of a quantity which characterizes the range of values within which the "true value" is asserted to lie with a stated level of confidence. [*ISO Guide 30:1992*] (2) Parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand. [*VIM:1993*]

Traceability — Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties.

1. The concept is often expressed by the adjective "traceable."
2. The unbroken chain of comparisons is often called a "traceability chain". [*VIM:1993*]
   a. This definition applies both to physical and chemical measurements.
   b. Traceability only exists when metrological evidence, appropriate for the application, is collected on a continuing basis to document the traceability chain and quantify its associated measurement uncertainties.
   c. In most cases, the ultimate stated reference for a measurement result is the SI definition of the appropriate unit(s). [*NORAMET Document No. 7 (1995-11-13)*]

NIST Standard Reference Material® (SRM®) — Certified reference material (CRM) issued by NIST. A SRM is a well-characterized material produced in quantity to improve measurement science. It is certified for specific chemical or physical properties, and is issued by NIST with a certificate that reports the results of the characterization and indicates the intended use of the material. A SRM is prepared and used for three main purposes:

1. To help develop accurate methods of analysis;
2. To calibrate measurement systems used to
   a. Facilitate exchange of goods,
   b. Institute quality control,
   c. Determine performance characteristics, or
   d. Measure a property at the state-of-the-art limit; and
3. To assure the long-term adequacy and integrity of measurement quality assurance programs.

NIST Reference Material (RM) — Material issued by NIST with a report of investigation instead of a certificate to:

1. Further scientific or technical research;
2. Determine the efficacy of a prototype reference material;
3. Provide a homogeneous and stable material so that investigators in different laboratories can be assured that they are investigating the same material;
4. Assure availability when a material produced and certified by an organization other than NIST, is deemed to be in the public interest or when an alternate means of national distribution does not exist.

NOTE: A NIST RM meets the ISO definition for a RM and may meet the ISO definition for a CRM (depending on the organization that produced it).

NIST Traceable Reference Material (NTRM) — A commercially produced reference material with a well-defined traceability linkage to existing NIST standards for measurements. This traceability linkage is established via criteria and protocols defined by NIST to meet the needs of the metrological community to be served. (Commercial reference materials producers will be allowed to affix the "NTRM" trademark to materials produced according to these criteria and protocols.) NOTE: A NIST NTRM may be recognized by a regulatory authority as being equivalent to a CRM.

NIST certified value — Value and its uncertainty assigned by NIST in conformance with the NIST uncertainty policy. A NIST certified value is obtained by one or more of the following measurement modes:

1. A definitive (or primary) method using specialized instrumentation capable of high accuracy and precision and whose errors have been thoroughly investigated and corrected; or,
2. Two or more independent methods at NIST using commercial instrumentation that is calibration based and with differing sources of systematic errors; or,
3. Interlaboratory data from selected laboratories using multiple methods and NIST SRMs as controls. NOTE: The sources of error with this mode will generally result in uncertainties greater than those for the other two modes.

NIST noncertified values — Values that do not meet the criteria for NIST certified values. Such values may be referred to as **NIST reference values** or **NIST information values**. NOTE: Noncertified values are often upgraded to certified values after additional measurements are performed and/or improved methodologies are applied.

- **NIST reference values** — Noncertified values with associated uncertainties that reflect only the precision of the measurement, do not include all sources of uncertainty, or reflect a lack of sufficient statistical agreement among multiple methods. Reference values may also be the results of analyses that are method-dependent.
- **NIST information values** — Noncertified values with no uncertainties reported or with estimated uncertainties for which there is insufficient information to make an assessment of the uncertainties. NOTE: Information values are often simply intended to provide additional descriptive information about a material.

NIST SRM Certificate (and Certificate of Analysis) — Document stating the intended purpose and application of a SRM, its certified property value(s) with associated uncertainty(ies), and any other technical information deemed necessary for its proper use. In accordance with *ISO Guide 31:1996*, a NIST SRM certificate bears the logo of the U.S. Department of Commerce, the name of NIST as certifying body, and the name and title of the NIST officer authorized to accept responsibility for its contents. NOTE 1: A SRM certified for one or more specific physical or engineering performance properties is issued with a Certificate; A SRM certified for one or more specific chemical properties is issued with a Certificate of Analysis. NOTE 2: A SRM certificate may contain NIST reference and/or information values in addition to certified values.

NIST Certificate of Traceability — Document stating the purpose, protocols, and measurement pathways that support claims by a NTRM to specific NIST standards or stated references. There are no NIST certified values provided in a certificate of traceability. Rather, the document references a specific NIST report of analysis. A NIST certificate of traceability bears the logo of the U.S. Department of Commerce, the name of NIST as certifying body, and the name and title of the NIST officer authorized to accept responsibility for its contents.

NIST RM Report of Investigation — Document issued with a RM and containing all the technical information necessary for proper use of the material. There are no NIST certified values provided in a report of investigation and authorship of a report's contents may be an organization other than NIST. A NIST RM Report of Investigation bears the logo of the U.S. Department of Commerce and the name and title of the NIST officer authorized to issue it.

The SRM/RM Identification System

The SRM Program offers for sale over 1200 different materials and adds 20 to 30 new materials as well as over one hundred renewal materials to its inventory each year. These materials all bear distinguishing names, numbers, and letters by which they are permanently and uniquely identified. The purpose of such identifiers is to clearly describe each and every material and, at the same time, systematically differentiate one from the other. The following certificate headings illustrate "what's in the SRM or RM name."

Certificate of Analysis — denotes a chemical composition SRM

Standard Reference Material® 3102a — primary SRM numerical identifier; renewal letter identifier (a = first renewal issue)

intended use: Standard Solution

material description constituent certified: Antimony

Lot No. 791103 — lot number (specific to batch lot produced units)

Certificate — denotes a physical property SRM

Standard Reference Material® 2520 — primary SRM numerical identifier

material description, intended use, and property certified: Optical Fiber Diameter Standard

Serial No: X10001Y — serial number (specific to individually certified units)

Report of Investigation — denotes a NIST reference material

Reference Materials 8050, 8051, 8052 — primary RM numerical identifier(s)

material(s) description: Fine Gold FAU6 Block, Wire and Turnings

ROYAL CANADIAN MINT — certifying organization

Certificate of Traceability — denotes a NTRM

material description and intended use: Carbon Monoxide in Nitrogen

constituent certified: (Nominal Amount-of-Substance Fraction - 5000 μmol/mol)

NIST Traceable Reference Material No. 82638 — primary NTRM numerical identifier

Batch No.: 960901 — batch number (specific to batch lot produced units)

For convenience, the acronyms "SRM®", "RM", and "NTRM" are preferentially used in conjunction with the primary numerical identifiers (including renewal letters - if applicable), to describe all NIST reference materials. This catalog and its supplement are no exceptions; thus, the reference materials described herein, are identified by their "short" titles (e.g., "SRM 3102a") rather than by their "long" titles (e.g., "Standard Reference Material® 3102a"). These short titles preserve the unique identifications of the materials involved and should be used in lieu of "catalog numbers" when ordering NIST reference materials.

Preparation and Availability of SRMs

New and renewal SRMs are being prepared continually. While these SRMs are included in the next edition of the catalog and its supplements, prospective users whose names are on the SRM mailing list are also notified as soon as the new items become available. Requests for placement on the SRM mailing list can be submitted at any time to the SRM Program Sales Office.

Renewal SRMs are intended to be completed before the supply of an existing SRM is exhausted. However, this is not always possible and a SRM may be out of stock for a time. When this occurs, those ordering the material are so notified and possible substitute SRMs are suggested. When a renewal is issued, customers who have ordered the previous lot are promptly notified of the price and availability of the renewal. If little demand exists or if an alternate source of supply becomes available, production of a SRM may be discontinued permanently.

Renewal SRMs may not be identical to the preceding lot; however, they meet the same specifications and can be used for the same purpose. For example, the first 0.1% carbon Bessemer steel was prepared in 1909 (Standard Sample No. 8). Since then a number of renewals, 8a, 8b, 8c, etc., have been prepared. The current SRM 8j 0.1C, represents the eleventh issue of the material. Each issue differs somewhat in detailed analysis; thus the use of the specific certificate for SRM 8j is essential.

Guide for Requesting Development of SRMs

NIST has the responsibility to develop, produce, and distribute SRMs that provide a basis for comparison of measurements on materials, and that aid in the control of production processes. To carry out this function, the SRM Program evaluates the needs and requirements of science, industry, and government for well-characterized reference materials, and directs the production and distribution of such materials. To become a SRM, a candidate material must meet one or more of the following criteria:

1. It would permit users to attain more accurate measurements.
2. Its production elsewhere would not be economically or technically feasible.
3. It would be an industry-wide standard for commerce from a neutral source not otherwise available to the public.
4. Its production by NIST would assure continued availability of a well-characterized material important to science, industry, or government.

NIST recognizes and responds to requests to enlarge the scope of the SRM Program to include all types of well-characterized materials for use in calibrating measurement systems, or for producing scientific data that can be referred to a common base. However, the requests for new SRMs greatly exceed NIST's capacity to produce and certify such materials. Consequently, requests for new SRMs of limited need or use are deferred in favor of requests that clearly show a critical technological or regulatory need and significant industrial and/or metrological impact. To determine which requests receive priority, NIST seeks and uses information supplied by industry, academia, governmental agencies, and such voluntary standards development organizations as the American Society for Testing and Materials (ASTM), etc., to objectively assess the urgency and importance of proposed new reference materials.

Requests to the SRM Program for the development of a new SRM should provide the following information:

1. Short title of the proposed SRM.
2. Purpose for which the SRM would be used.
3. Reasons why the SRM is needed.
4. Technical characteristics and requirements for the material. Additional requirements and reasons if more than one SRM is necessary for standardization in this area, should be included.
5. Estimates of the probable present and future (5 to 10 years) demand for such a SRM, nationally and internationally.
6. Justification for SRM preparation by NIST, particularly if a similar one could be produced or obtained from another source.
7. Pertinent information to aid justification for the SRM, such as: (a) an estimate of the potential range of application, monetary significance of the measurement(s) affected, scientific and technological significance including, when feasible, estimates of the impact upon industrial productivity, growth, quality assurance or control, and (b) supporting letters from industry leaders, trade organizations, interested standards committees, and others.

All such requests should be addressed to:

Standard Reference Materials Program
National Institute of Standards and Technology
Room 112, Building 202
Gaithersburg, MD 20899-0001
ATTN: SRM Development

SRM Catalog

New catalogs of NIST SRMs and RMs are published approximately every 2 years, listing materials available and renewal materials in preparation, and deleting discontinued materials. The Catalog is supplemented by Price Lists issued simultaneously with each new catalog and annually to keep the catalog current between editions. These supplements list current prices, and reflect any changes in material availability—listing new and renewal materials and deleting discontinued ones.

A guide and three indexes are provided for user convenience. They are described in the following section, **How to Use This Catalog.**

How to Use This Catalog

The ***NIST Standard Reference Materials Catalog 1998–99*** lists Standard Reference Materials (SRMs) and Reference Materials (RMs) issued by the NIST SRM Program. It consists of a guide and three indexes, each of which groups the SRMs and RMs according to a distinctive characteristic or descriptor. Selection of the guide or one index over another to locate the information desired will depend on the user's prior knowledge of a specific SRM or RM and intended SRM or RM application.

Guide to SRM/RM Technical Categories – This is a general listing based on the three major categories into which all the SRMs and RMs have been assigned. The ***categories*** are divided into sequentially numbered sections, each of which describes a material class or technical property class. The ***sections*** are further divided into subsections, each of which describes a specific type of material or technical property and the physical form(s) of the SRMs and RMs contained therein. The titles of the ***subsections*** are the descriptors for the tables comprising the catalog.

EXAMPLE

Category	–	Standard Reference Materials for CHEMICAL COMPOSITION, 31 through 96 (page nos.)
Section	–	102. **NONFERROUS METALS**, 44 through 52 (page nos.)
Subsection (Descriptor)	–	Zinc Base Alloys (chip and disk forms), 52 (page no.)

SRM/RM Subject Index – This index is based on short word descriptors (one to four words) of the SRMs and RMs in the catalog. These descriptors may identify a section, subsection, a material class, a specific SRM property, a specific SRM application, or a measurement technique. Some descriptors may coincidently also identify an individual SRM or RM; however, only a few SRMs or RMs will be so described. The index is arranged in ***alphabetical order of the first word of the descriptor.*** Because of the variety of descriptors used, some SRM and RM materials may be cross-referenced.

EXAMPLE

Index Entry	–	**ALLOYS (NONFERROUS)**
Descriptor (s)	–	See **NONFERROUS METALS**, 44 through 52 (page nos.)

or

Index Entry	–	**ZINC**
Descriptor	–	Spelter (ZINC BASE ALLOYS), 52 (page no.)

SRM/RM Numerical and Certificate Index – This index is based on the unique numerical identifier (also referred to by purchasing agents as *the **catalog number**)* assigned to each and every SRM and RM issued by NIST. This identifier is the ***SRM or RM Number***, an integral part of the reference material name which appears on each SRM certificate or RM report of investigation. The index lists all the SRMs and RMs sequentially by this number, beginning with SRM 1c and ending with RM 8761. A short word descriptor of the SRM or RM, the category subsection in which it is assigned, and the certificate or report of investigation ***date of issue*** are also provided for reference.

EXAMPLE

SRM	–	3168a
Descriptor	–	Zinc Standard Solution
Certificate Date	–	Jun 96
Section Code	–	104
Page	–	58 (page no.)

SRM/RM Material Safety Data Sheet (MSDS) Index – The index is similar to the Numerical and Certificate Index but it lists ***only*** those SRMs/RMs for which ***Material Safety Data Sheets (MSDSs)*** are required. The identifier is the ***SRM or RM Number*** and the short word descriptor used in the Numerical Index. These are followed by the ***MSDS Number***, which usually carries the same SRM/RM number identifier, *and **its date of issue***. In accordance with applicable national and international regulations, a copy of the MSDS accompanies every shipment of its relevant SRM/RM.

EXAMPLE

SRM	–	3168a
Descriptor	–	Zinc Standard Solution
MSDS Number	–	3168a
MSDS Date	–	Oct 93
Numerical MSDS Index Page	–	181 (page no.)

HOW TO LOCATE SPECIFIC INFORMATION

- ***About an unknown SRM or RM material needed for a particular technical application*** –
  Refer to the **Guide to SRM/RM Technical Categories**, select the most appropriate of the three categories, review all the sections and subsections therein and note the page numbers.
- ***About a material from a specific class of materials and of known technical application*** –
  Refer to the **SRM/RM Subject Index,** check for alternative descriptors and cross-references, and note page numbers.
- ***About a material whose SRM or RM number is known*** –
  Refer to the **SRM/RM Numerical and Certificate Index** (green pages) and note the page number.
- ***Whether or not a SRM or RM has (or requires) a Material Safety Data Sheet*** –
  Refer to the **SRM/RM Numerical MSDS Index.**

Ordering NIST Reference Materials

General

Purchase orders (in English) for all NIST SRMs/RMs should be directed to:

Standard Reference Materials Program
National Institute of Standards and Technology
Room 204, Building 202
Gaithersburg, MD 20899-0001
USA

Telephone: (301) 975–6776
Fax: (301) 948–3730
E-Mail: srminfo@nist.gov

Each purchase order should give the number of units, catalog number, and name of each reference material requested.

Example: 1 each, SRM 79a, Fluorspar Customs Grade.

The following information must be included with each order: a billing address, a shipping address, name of customer, telephone number, fax number, purchase order number, a customer identification number, i.e., a social security number (SSN) for consumer customers, tax identification number (TIN) for commercial customers, or agency code (ALC) for U.S. Government customers.

Note: NIST SRMs/RMs are only distributed in the units of issue listed in this catalog and its supplement (price list). Also, purchase orders or inquiries submitted in a language other than English, will take several weeks to process.

Acceptance of an order does not imply acceptance of any provisions set forth in the order that are contrary to the policies, practices, or regulations of the National Institute of Standards and Technology or the United States Government.

Out-of-Stock Materials

Orders for "out-of-stock" SRMs/RMs, are generally filled with the renewal reference materials — if available; otherwise the orders will be canceled. Customers are notified when an order is canceled and their names are placed on a notification list. This list is used to contact customers when the reference material (or its renewal) is again available. Upon notification, customers are told the price of the material and are asked to submit a new order if they still wish to purchase it.

For some SRMs/RMs, production lots are small and stock outages occur frequently. In these cases, the notification list is used to fill orders on a *"first come, first served"* basis. Customers are contacted when the reference materials are again available and are asked to confirm their original purchase orders.

Terms and Conditions

Prices quoted for SRMs/RMs are in U.S. dollars ($), and are published in the catalog supplement (price list). The prices shown therein are subject to change without notice and orders will be invoiced for the prices in effect at the time of shipment. Shipping and handling charges for regular and special (for SRMs in restricted categories) shipments are also applied to all orders. These charges will be added to the invoices.

Note: A 10% discount is given on individual purchase orders for 50 or more SRM units (single SRM, or combination of SRMs).

Payment of all invoices is expected within 30 days of receipt for domestic orders; 45 days of receipt for foreign orders, and may be made by any of the following:

- Banker's draft against U.S.A. bank,
- Bank to bank transfer to U.S.A. bank,
- Cash against documents,
- DISCOVER, MasterCard, and VISA,
- International money order.

Late Charges

In accordance with U.S. Treasury regulations, late charges will be levied for each 30/45-day period, or portion thereof, that an invoice payment is overdue.

Proforma Invoice (Price Quotation)

Proforma invoice service requires 3 to 4 weeks to process and is furnished **only** to those customers requiring such service.

Domestic Shipments

SRM/RM shipments within the continental United States are shipped F.O.B. Gaithersburg, MD. There are several shipping modes which can be used, including UPS Ground, Federal Express, Air Freight, and Motor Freight (Collect). Unless otherwise instructed by the customer, the mode of shipment will be selected by NIST. Fewer shipping modes are available to SRMs/RMs in restricted categories and NIST reserves the exclusive right to select the proper shipping mode for these types of shipments. For restricted SRM/RM shipments, an additional charge is incurred for each shipping container used. This charge is added to the invoice.

Foreign Shipments (and shipments to Alaska and Hawaii)

SRM/RM shipments outside the contiguous United States are also shipped F.O.B. Gaithersburg, MD by one of the following modes, including UPS International, Federal Express International (subject to size, weight, and category of material limitations), and Air Freight. Unless otherwise instructed by the customer, the mode of shipment will be selected by NIST. Any other mode of shipment requested by the customer must be paid by the customer. Fewer shipping modes are available to SRMs/RMs in restricted categories and NIST reserves the exclusive right to select the proper shipping mode for these types of shipments.

Restricted Shipments — Dangerous Goods (Hazardous Materials)

Some SRMs/RMs are classified as "Dangerous Goods" by the U.S. Department of Transportation (DOT), the International Civil Aviation Organization (ICAO), or the International Air Transport Association (IATA). These organizations have published regulations and procedures for packaging and shipping dangerous (hazardous) goods which must be followed to safely transport these materials. Such regulations and procedures are very specific and do not allow exceptions. NIST reserves the exclusive right to select the proper packaging and shipping mode to assure that shipments comply with these regulations and procedures.

Restricted Shipments — Temperature Sensitive Materials

Some SRMs are extremely temperature sensitive and will perish unless shipped by the most expedient mode available. To ensure the stability of these materials, they must be packaged with Cool Packs or dry ice which will maintain the necessary low temperatures for a short period of time. However, *several SRMs are so temperature sensitive that they are restricted to domestic sales only*, and must be shipped according to a set schedule.

Documentation (All documents are printed in English)

The documentation NIST furnishes are:

a. Commercial invoice(s),
b. Packing slip(s),
c. Air waybill for air shipments (provided UPON REQUEST ONLY),
d. NAFTA Certificate(s) (when applicable),
e. SRM/RM Certificate(s) — one for each unit ordered,
f. Material Safety Data Sheet(s) — one for each type of ordered material requiring it.

SRM/RM Certificates and Material Safety Data Sheets

Each SRM/RM shipment contains sufficient copies of Certificates and Material Safety Data Sheets (MSDSs) (if applicable) for the number of units ordered. However, if these documents are misplaced, NIST will provide additional copies free of charge upon request and when proof of purchase has been provided. Customers may call, fax, or use the following e-mail addresses to send in their requests:

for Certificates — srmcert@nist.gov
for MSDSs — srmmsds@nist.gov

Requests will usually be processed within 24 hours. Documents under or equalling ten pages will be faxed; documents exceeding ten pages will be mailed. If the documentation is urgently needed, the customer must provide a Federal Express account number.

NIST also provides copies of misplaced "Archive certificates" free of charge to customers who possess NIST SRMs/RMs that are no longer for sale. This service is available on a one-time-only basis.

CUSTOMERS ARE REQUIRED TO INSPECT ALL PACKAGES AND DOCUMENTATION IMMEDIATELY UPON RECEIPT OF SHIPMENT. ANY DAMAGE, SHORTAGES OR DEFECTS MUST BE REPORTED TO SRM PROGRAM CUSTOMER SERVICE AT (301) 975-6776, WITHIN FIVE DAYS OF RECEIPT OF SHIPMENT.

Rush Shipments

Requests for rush shipments will be accommodated when possible. However, they will be made in compliance with existing regulations pertaining to the SRMs/RMs being shipped and when hazardous materials are involved, all regulations governing their transportation will take precedence. The following types of rush shipments are available:

- Same day shipping — Orders must be placed by **10:00 AM Eastern Standard Time (EST)**. In addition to the normal shipping fees, a processing fee of $50.00 will be added to the customer's invoice.
- Next day shipping — In addition to the normal shipping fees, a processing fee of $25.00 will be added to the customer's invoice.

  (Exception: Hazardous materials will not be shipped the same day.)

Returned Goods

NIST SRMs/RMs are generally not returnable — with the exception of defective goods or shipments made in error by NIST. However, normal transaction of business inevitably requires the occasional return of merchandise for exchange or credit. NIST has therefore instituted the following returned goods policy:

- Return shipments are accepted by NIST **only after** specific arrangements to do so have been made. To return a SRM/RM, contact the SRM Program Sales Office to **obtain a Return Authorization Number and shipping instructions**. REQUESTS FOR RETURN AUTHORIZATION MUST BE MADE WITHIN 30 DAYS OF RECEIPT OF SHIPMENT.

- Return shipments of hazardous SRMs/RMs authorized by SRM Program Sales Office, must be packed, marked, labeled, and shipped in accordance with national and international regulations governing their transportation. Opened, leaking or damaged hazardous SRM/RM units and/or their containers CANNOT BE RETURNED TO NIST but should be disposed of in accordance with applicable laws and regulations.

Returns which will not be authorized or accepted UNDER ANY CIRCUMSTANCES include:

- **Perishable SRM/RMs,**
- **Unsealed, partially used, modified or mutilated SRMs/RMs,**

Other Services of the National Institute of Standards and Technology

Calibration and Related Measurement Services

The fee based measurement services of the Calibration Program include calibrations, special tests, and Measurement Assurance Programs (MAPs). The calibrations and MAPs of NIST satisfy the most demanding and explicit measurement requirements, in that these services are carried out regularly under pre-established and well-defined conditions; the measurement processes involved are well-characterized, stable and in a state of statistical control; and quality control procedures are well-defined and strictly followed. These services are described in NIST Special Publication 250, *Calibration Services Users Guide*. For more information on available calibration services, or how to obtain a copy of Special Publication 250, inquiries should be directed to:

Calibration Program	Telephone:	(301) 975–2002
National Institute of Standards and Technology	Fax:	(301) 869–3548
Room 232, Building 820	E-Mail:	calibrations@nist.gov
Gaithersburg, MD 20899-0001	Internet:	http://ts.nist.gov/calibrations

Standard Reference Data Program

The Standard Reference Data Program provides well-documented numeric data to scientists and engineers for use in technical problem solving, research, and development. These recommended values are based on data which have been extracted from the world's literature, assessed for reliability, and then evaluated to select the preferred values. The primary vehicles for dissemination of this data are the *NIST Standard Reference Database Series* and the *Journal of Physical and Chemical Reference Data (JPCRD)*. For database and publication information, please contact the following:

Standard Reference Data Program	Telephone:	(301) 975–2208
National Institute of Standards and Technology	Fax:	(301) 926–0416
Room 113, Building 820	E-Mail:	srdata@nist.gov
Gaithersburg, MD 20899-0001	Internet:	http://www.nist.gov/srd

Accreditation of Laboratories

The National Voluntary Laboratory Accreditation Program (NVLAP) accredits public and private calibration and/or testing laboratories, based on evaluation of their technical qualifications and competence for conducting specific tests or types of tests in specified fields of testing or calibration. Accreditation is based on criteria published in the Code of Federal Regulations as part of the NVLAP procedures. Accreditation is granted following successful completion of a process which includes submission of an application and payment of fees by the laboratory, an on-site assessment, resolution of any deficiencies identified during the on-site assessment, participation in proficiency testing, technical evaluation, and administrative review. The accreditation is formalized through issuance of a Certificate of Accreditation and Scope of Accreditation as publicized by announcement in various government and private media. Application packages may be obtained from:

National Voluntary Laboratory Accreditation Program	Telephone:	(301) 975-4016
National Institute of Standards and Technology	Fax:	(301) 926-2884
Room 282, Building 820	E-Mail:	nvlap@nist.gov
Gaithersburg, MD 20899-0001	Internet:	http://ts.nist.gov/nvlap

National Center for Standards and Certification Information

The National Center for Standards and Certification Information (NCSCI) provides information on U.S., foreign and international voluntary standards, government regulations, and conformity assessment procedures for non-agricultural products. NCSCI staff respond to inquiries by identifying relevant standards and/or regulations, maintain a reference collection of standards and standards-related documents (they do not provide copies), and serve as the U.S. inquiry point for information to and from foreign countries. Inquiries should be directed to:

National Center for Standards and
Certification Information
National Institute of Standards and Technology
Room 164, Building 820
Gaithersburg, MD 20899-0001

Telephone: (301) 975-4040
Fax: (301) 926-1559
E-Mail: ncsci@nist.gov
Internet: http://ts.nist.gov/oss

Weights and Measures Program

The NIST Weights and Measures Program operates a Type Evaluation Program which provides for an evaluation of (1) prototype weighing and measuring devices to determine compliance with the requirements of NBS Handbook 44, "Specifications, Tolerances, and Other Technical Requirements for Commercial Weighing and Measuring Devices," (2) standards to determine compliance with the requirements of NBS Handbook 105–1, 105–2, 105–3, "Specifications and Tolerances for Reference Standard and Field Standard Weights and Measures." This program may be used by manufacturers and weights and measures officials in determining the acceptability of devices for commercial use or the suitability of reference and field standards. For information on programs of NIST and the States, write or telephone:

Weights and Measures Program
National Institute of Standards and Technology
Room 232, Building 820
Gaithersburg, MD 20899-0001

Telephone: (301) 975-4004
Fax: (301) 926-0647
E-Mail: owm@nist.gov
Internet: http://www.nist.gov/owm

Proficiency Sample Programs

General information on the Proficiency Sample Programs may be obtained from:

Construction Materials Reference Laboratories
National Institute of Standards and Technology
Room A365, Building 226
Gaithersburg, MD 20899-0001

Telephone: (301) 975-6704
Fax: (301) 330-1956
E-Mail: jpielert@nist.gov
Internet: http://www.bfrl.nist.gov/862/ccrl/front.htm

Information is available on the following programs:

Proficiency Sample Programs for Hydraulic Cements, Pozzolans, and Portland Cement Concrete;
Proficiency Sample Programs for Soils, Aggregates, and Bituminous Materials;
Inspection of Cement and Concrete Testing Laboratories;
Inspection of Soils and Bituminous Testing Laboratories.

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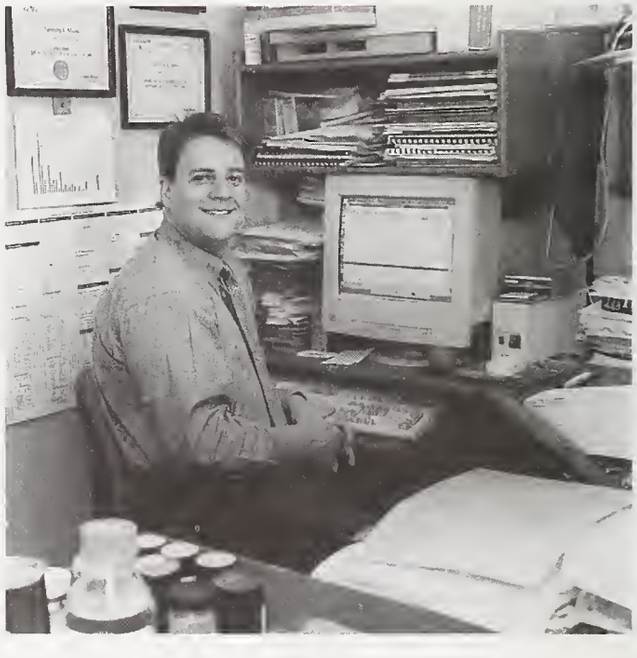

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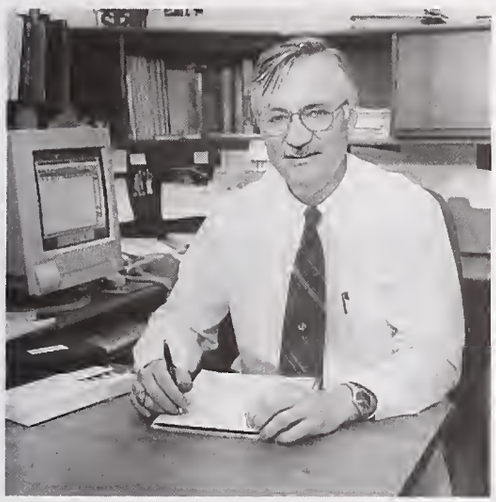

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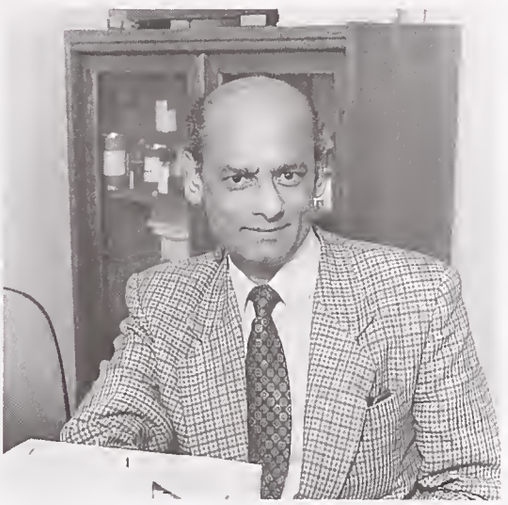

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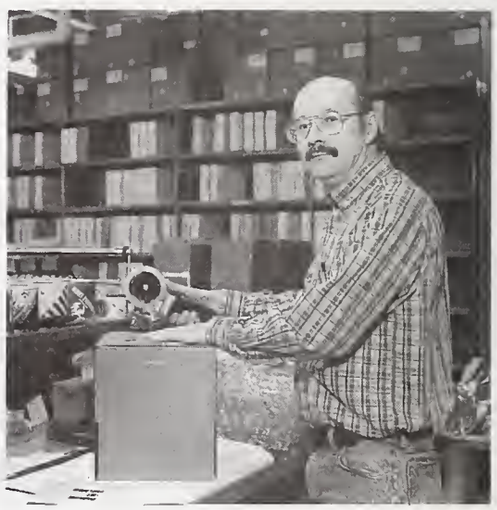

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Guide to SRM/RM Technical Categories

Standard Reference Materials for CHEMICAL COMPOSITION

Standard Reference Materials for PHYSICAL PROPERTIES

Standard Reference Materials for ENGINEERING MATERIALS

Chemical Composition

Standard Reference Materials for Chemical Composition

101. Ferrous Metals

Plain Carbon Steels (chip form)

These SRMs are for checking chemical methods of analysis. They consist of steel alloys selected to provide a wide range of analytical values for elements. They are furnished in 150-g units (unless otherwise noted) as chips usually sized between 0.4 mm to 1.2 mm, prepared from selected portions of commercial ingots.

SRM	Type	Elemental Composition (mass fraction, in %)				
		C	Mn	P	S	Si
8j	0.1C	0.081	0.505	0.095	0.077	0.058
11h	0.2C	0.200	0.510	0.010	0.026	0.211
12h	0.4C	0.407	0.842	0.018	0.027	0.235
13g	0.6C	0.613	0.853	0.006	0.031	0.355
14g	AISI 1078	0.735	0.456	0.006	0.019	0.232
15h	0.1C	0.076	0.373	0.005	0.019	0.008
16f	1.1C	0.97	0.404	0.014	0.026	0.214
19h	0.2C	0.215	0.393	0.016	0.022	0.211
20g	AISI 1045	0.462	0.665	0.012	0.028	0.305
152a	0.5C (Tin bearing)	0.486	0.717	0.012	0.030	0.202
178	0.4C	0.395	0.824	0.012	0.014	0.163
337a	1.1C (Carbon & Sulfur) (300 g)	0.969			0.024	
368	AISI 1211	0.089	0.82	0.084	0.132	0.007

SRM	Cu	Ni	Cr	V	Mo	Co	Ti	Sn	Al (total)	N
8j	0.020	0.113	0.047	0.015	0.038					
11h	0.061	0.028	0.025	0.001			0.004			
12h	0.073	0.032	0.074	0.003	0.006				(0.038)	0.006
13g	0.066	0.061	0.050	0.001					0.048	
14g	0.047	0.030	0.081	0.0008	0.011				0.025	
15h	0.013	0.017	0.018	<0.001	0.009				0.061	
16f	0.006	0.008	0.020	0.002	0.003	0.003				
19h	0.466	0.248	0.173	0.003	0.038				0.002	
20g	0.034	0.034	0.036	0.002	0.008				0.040	
152a	0.023	0.056	0.046	0.001	0.036			0.032		
178	0.032	0.010	0.016	0.001	0.003					
368	0.010	0.008	0.030	0.001	0.003					0.010

Values in parentheses are not certified and are given for information only.

101. Low Alloy Steels (chip form) [150-g units (unless otherwise noted)]

SRM	Type	Elemental Composition (mass fraction, in %)						
		C	Mn	P	S		Si	Cu
					Grav	Comb		
30f	Cr–V (SAE 6150)	0.490	0.79	0.011		0.009	0.283	0.074
32e	Ni–Cr (SAE 3140)	0.409	0.798	0.008	0.022	0.021	0.278	0.127
33e	Ni–Mo (SAE 4820)	0.186	0.525	0.005		0.009	0.262	0.070
36b	Cr–Mo	0.114	0.404	0.007		0.019	0.258	0.179
72g	AISI 4130	0.278	0.492	0.009		0.014	0.223	0.011
100b	Manganese (SAE 340)	0.397	1.89	0.023	0.029	0.028	0.210	0.064
106b	Cr–Mo–Al (Nitralloy™ G)	0.326	0.506	0.008	0.016	0.017	0.274	0.117
125b	High Silicon	0.028	0.278	0.029		0.008	2.89	0.071
129c	High Sulfur (SAE 112)	0.125	0.769	0.076		0.245	0.020	0.013
131f	High Silicon	0.0035				0.000434*		
139b	Cr–Ni–Mo (AISI 8640)	0.403	0.778	0.013		0.019	0.242	0.097
155	Cr–W	0.905	1.24	0.015	0.010	0.011	0.322	0.083
163	Cr (**100 g**)	0.933	0.897	0.007		0.027	0.488	0.087
179	High Silicon	0.027	0.094	0.006		0.026	3.19	0.056
291	Cr–Mo (ASTM A213)	0.177	0.550	0.008		0.020	0.230	0.047
293	Cr–Ni–Mo (AISI 8620)	0.222	0.960	0.018		0.022	0.300	0.032
2171	Ni–Cr–Cu–Mo (HSLA 100)	0.066	0.73	0.006		0.0012	0.338	1.47

SRM	Ni	Cr	V	Mo	Sn	Al (total)	N
30f	0.070	0.945	0.182				0.010
32e	1.19	0.678	0.002	0.023	(0.011)		0.009
33e	3.36	0.068	(0.001)	0.224	(0.002)	0.030	
36b	0.203	2.18	0.004	0.996			
72g	0.016	0.905	0.003	0.170		(0.041)	(0.008)
100b	0.030	0.063	0.003	0.237			0.004
106b	0.217	1.18	0.003	0.199		1.07	
125b	0.038	0.019		0.008	0.003	0.329	**Ca 0.0051**
129c	0.251	0.014	0.012	0.002			
139b	0.510	0.488	0.004	0.182			0.007
155	0.100	0.485	0.014	0.039			**W 0.517**
163	0.081	0.982		0.029			0.007
179	0.050	0.022	<0.01	0.014	0.004	0.0028	
291	0.065	1.33		0.538		0.002	
293	0.480	0.510	0.004	0.204		0.039	
2171	3.35	0.550	0.003	0.546		0.019	**Nb 0.024**

Values in parentheses are not certified and are given for information only.
*Value determined by isotope dilution mass spectrometric (IDMS) analysis.

101. Special Low Alloy Steels (chip and pin forms)
[150-g units (unless otherwise noted)]

SRM	Type	Elemental Composition (mass fraction, in %)							
		C	Mn	P	S	Si	Cu	Ni	Cr
361	AISI 4340	0.383	0.66	0.014	0.0143	0.222	0.042	2.00	0.694
362	AISI 94B17 (mod.)	0.160	1.04	0.041	0.0360	0.39	0.50	0.59	0.30
363	Cr–V (mod.)	0.62	1.50	0.029	0.0068	0.74	0.10	0.30	1.31
364	High Carbon (mod.)	0.87	0.255	0.01	0.0250	0.065	0.249	0.144	0.063
2159	Carbon & Sulfur only (**pin - 200 g**)	0.016			0.0023				
2160	Carbon & Sulfur only (**pin - 200 g**)	0.584			0.012				
2165	E	0.0059	0.144	0.0052	0.0038	(0.004)	0.0013	0.155	0.050
2166	F	0.015	0.066	0.0012	0.0023	0.010	0.015	0.022	0.024
2167	G	0.051	0.022	0.0031	0.0091	0.026	0.0014	0.002	0.0015
2168	High-Purity Iron	0.0007	0.0006	0.0015	0.0010	(<5.0)*	0.0005	0.0012	0.0003

SRM	V	Mo	W	Co	Ti	As	Sn	Al (total)	Nb	Ta	Zr	N	Ca
361	0.011	0.19	0.017	0.032	0.020	0.017	0.010	0.021	0.022	0.020	0.009	(0.0037)	0.00010
362	0.040	0.068	0.20	0.30	0.097	0.092	0.016	0.083	0.29	0.20	0.19	(0.00404)	0.00021
363	0.31	0.028	0.046	0.048	0.050	0.010	0.104	0.24	0.049	(0.053)	0.049	(0.0041)	0.00022
364	0.105	0.49	0.10	0.15	0.24	0.052	0.008	(0.008)	0.157	0.11	0.068	(0.0032)	0.00003
2165	0.0040	0.0055		0.0012	0.0051	0.0010	0.002	(0.006)	0.0004	(0.004)			
2166	0.009	0.0035		0.0022	0.0007	0.0035	0.0010	0.012	0.005	(0.011)	(0.0004)		
2167	0.033	0.020		0.0050	0.010	0.0005	0.006	0.0045	0.0095	(0.002)	(0.004)		
2168	(<1.0)*	(<7.0)*	(<7.0)*	0.0006	(<3.0)*	(<1.0)*	(<1.0)*	(<5.0)*	(<5.0)*	(<1.0)*	(<5.0)*	0.0007	(<2.0)*

SRM	B	Pb	Sb	Bi	Ag	Se	Te	Ce	La	Nd	Fe
361		0.000025	0.0042	(0.0004)	0.0004	(0.004)	(0.0006)	0.0040	(0.001)	0.00075	(95.6)
362	0.0025	0.00048	0.013	(0.002)	0.0011	(0.0012)	(0.0005)	0.0019	(0.001)	0.00075	(95.3)
363		0.00186	0.002	(0.0008)	0.0037	(0.00016)	(0.0009)	0.0030	(0.002)	0.0012	(94.4)
364	0.0106	0.0230	0.034	(0.009)	(0.00002)	(0.00021)	(0.0002)	0.00057	(0.0002)	0.00018	(96.7)
2165	(0.0009)	0.0003	0.0010	(<0.0001)	0.0002	(0.0035)	(0.003)				
2166	(0.0004)	0.003	0.0005	(<0.0001)	0.0005	(0.0035)	(0.003)				
2167	(0.001)	(<0.0001)	0.0020	(<0.0001)	0.0007		(0.0003)				
2168	(<1.0)*	(<1.0)*	(<3.0)*	(<3.0)*		(<2.0)*	(<1.0)*				

SRM	Mg	Zn	Pr	Ge	O	H	Au	Hf	Sr
361	0.00026	(0.0001)	(0.0003)	[0.006]	(0.0009)	(<0.0005)	(<0.00005)	(0.0002)	(<0.0005)
362	0.00068	(0.00012)	(0.0003)	[0.002]	(0.00107)	(<0.0005)	(<0.00005)	(0.0003)	(<0.0005)
363	0.00062	(0.0004)	(0.0004)	[0.010]	(0.00066)	(<0.0005)	0.0005	(0.0005)	(<0.0005)
364	0.00016	[0.001]	(0.0001)	[0.003]	(0.0010)	(<0.0005)	0.0001	(0.0013)	(0.001)
2165	(<0.0001)								
2166	(<0.0001)								
2167	(<0.0001)								
2168	(<5.0)*	(<5.0)*			0.010	**Cd (<1.0)***			

Values in parentheses are not certified and are given for information only.
Values in brackets are approximate values from heat analysis and are given for information only.
*Value is in mg/kg.

101. High Alloy Steels (chip form) [150-g units (unless otherwise noted)]

SRM	Type	Elemental Composition (mass fraction, in %)					
		C	Mn	P	S	Si	Cu
					Comb		
126c	High Nickel (36% Ni)	0.025	0.468	0.004	0.005	0.194	0.040
344	Cr–Ni (Mo Precipitation Hardening)	0.069	0.57	0.018	0.019	0.395	0.106
345a	Cr–Ni (Cu Precipitation Hardening)	0.040	0.79	0.024	0.012	0.61	3.39
346a	Valve Steel	0.502	9.16	0.031	0.002	0.219	0.375
348a	High Temperature Alloy (A286) Ni–Cr	0.044	0.64	0.023	0.0007	0.43	0.14
862	High Temperature Alloy L605 (**100 g**)	0.120	1.59	0.002	0.0008	0.017	0.0010
868	High Temperature Alloy Fe–Ni–Co (**100 g**)	0.022	0.052	<0.003	0.0025	0.097	0.022

SRM	Ni	Cr	V	Mo	Co	Ti	Al (total)	Nb	Ta	B	Fe
126c	36.05	0.062	0.001	0.011	0.008						
344	7.28	14.95	0.040	2.40		0.076	1.16				
345a	4.27	15.52	0.080	0.43	0.099	(<0.01)	(<0.01)	0.27	(<0.01)	(<0.001)	N **0.031**
346a	3.43	21.08	0.096	0.237	(0.05)	(<0.001)	(0.001)	(0.01)	**Sn (0.008)**	(<0.001)	N **0.442**
348a	24.2	14.8	0.23	1.18	0.15	2.12	0.24	(0.07)	**W (0.07)**	0.0055	(55.2)
862	9.74	20.0	0.005	N **0.026**	51.5	**W 15.1**	(<0.01)	(<0.005)	(<0.01)	(<0.0001)	1.80
868	37.78	0.077	0.077	0.014	16.1	1.48	0.99	2.99	0.003	0.0078	40.5

Values in parentheses are not certified and are given for information only.

101. Gases in Metals (rod form)

These SRMs are for determining hydrogen, oxygen, and nitrogen by vacuum fusion, inert gas fusion, and neutron activation methods.

SRM	Type	Oxygen (in mg/kg)	Hydrogen (in mg/kg)	Nitrogen (in mg/kg*)
1090	Ingot Iron	491		(60)
1091a	Stainless Steel (AISI 431)	132.2		(876)
1093	Valve Steel	60		
1094	Maraging Steel	4.5		(71)
*1095	Steel (AISI 4340)	9	(<5)	(37)
*1096	Steel (AISI 94B17)	10.7	(<5)	40.4
*1097	Cr–V Steel (mod.)	6.6	(<5)	(<11)
*1098	Steel (High Carbon)	10	(<5)	32
*1099	Electrolytic Iron	61	(<5)	(13)
1754	Low Alloy Steel (AISI 4320)	24		81

Values in parentheses are not certified and are given for information only.
*These SRMs are sold **only** as a set designated SRM 1089.

101. Stainless Steels (chip form) [150-g units (unless otherwise noted)]

SRM	Type	Elemental Composition (mass fraction, in %)					
		C	Mn	P	S	Si	Cu
73c	Cr (SAE 420)	0.310	0.330	0.018	0.036	0.181	0.080
101g	AISI 304 L (**100 g**)	0.0136	0.085	0.007	0.0078	1.08	0.029
121d	Cr–Ni–Ti (AISI 321)	0.067	1.80	0.019	0.013	0.54	0.121
123c	Cr–Ni–Nb (AISI 348)	0.056	1.75	0.024	0.014	0.59	0.103
133c	Cr–Mo	In Prep					
160b	Cr–Ni–Mo (AISI 316)	0.044	1.64	0.020	0.016	0.509	0.172
166c	Carbon Only (**100 g**)	0.0078					
339	Cr–Ni–Se (SAE 303Se)	0.052	0.738	0.129	0.013	0.654	0.199
343a	Cr–Ni (AISI 431)	0.149	0.42	0.026	0.001	0.545	0.162
367	Cr–Ni (AISI 446)	0.093	0.315	0.018	0.016	0.58	
893	Cr (SAE 405)	0.027	0.378	0.022	0.0003	0.326	0.261
895	Cr–Mn (SAE 201)	0.066	7.09	0.038	0.0033	0.399	0.439

SRM	Ni	Cr	V	Mo	Co	Ti	Nb	Ta	Pb	Se	N
73c	0.246	12.82	0.030	0.091							0.037
101g	10.00	18.46	0.041	0.004	0.09						
121d	11.17	17.43		0.165	0.10	0.342					
123c	11.34	17.40		0.22	0.12		0.65	<0.001			
160b	12.26	18.45	0.047	2.38	0.101				0.001		0.039
339	8.89	17.42	0.058	0.248	0.096					0.247	
343a	2.16	15.64	0.056	0.164	(0.04)	(<0.001)	(0.01)	**Al (0.001)**	(<0.0001)	**B (<0.001)**	0.078
367	0.29	24.19	0.08								0.168
893	0.192	13.55	0.080	0.023	0.020	(0.01)	(<0.0005)	(<0.001)	(0.0001)	(<0.0001)	**Al (0.20)**
895	5.34	16.72	0.079	0.337	0.126	(<0.0004)	(<0.009)	(<0.001)	(0.0001)	(<0.0001)	**W (0.03)**

Values in parentheses are not certified and are given for information only.

101. Tool Steels (chip form) [150-g units]

SRM	Type	Elemental Composition (mass fraction, in %)						
		C	Mn	P	S		Si	Cu
					Grav	Comb		
50c	W–Cr–V	0.719	0.342	0.022	0.010	0.009	0.311	0.079
132b	Tool Steel (AISI M2)	0.864	0.341	0.012		0.004	0.185	0.088
134a	Mo–W–Cr–V	0.808	0.218	0.018	0.007	0.007	0.323	0.101
2172	S-7 Tool Steel	0.480	0.61	0.008		0.0031	0.263	0.083

SRM	Ni	Cr	V	Mo	W	Co	Sn	As	N
50c	0.069	4.13	1.16	0.082	18.44		0.018	0.022	0.012
132b	0.230	4.38	1.83	4.90	6.28	0.029			
134a	0.088	3.67	1.25	8.35	2.00				
2172	1.04	3.11	0.234	1.37					

Steel SRMs described in this and the following three pages are furnished in various forms. The 600 series is for microchemical methods of analysis, such as electron probe microanalysis and laser probe analysis. The 1100, 1200, and 1700 series are for optical emission and x-ray spectrometric methods of analysis. These materials have been prepared to ensure high homogeneity.

Nominal Sizes for Solid Steel SRMs:

600 Series: 3.2 mm diameter and 51 mm long.
1100 and 1200 Series: 31 mm diameter and 19 mm thick.
1700 Series: 34 mm diameter and 19 mm thick.
A "C" preceding the SRM number indicates a chill cast sample; 31 mm diameter and 19 mm thick.

101. Low Alloy Steels (disk and rod forms)

SRM	Type	Elemental Composition (mass fraction, in %)				
		C	Mn	P	S	Si
661	AISI 4340	0.392	0.66	0.015	0.015	0.223
663	Cr–V (mod.)	0.57	1.50	0.029	0.0055	0.74
664	High Carbon (mod.)	0.871	0.258	0.010	0.025	0.066
665	Electrolytic Iron	0.008	0.0057	0.0025	0.0059	0.0080
1134	High Silicon	0.026	0.277	0.028	0.009	2.89
1135	High Silicon	0.027	0.094	0.006	0.026	3.19
1218	High Silicon, Low Carbon & Sulfur	0.0029	0.014	(0.002)	0.0011	(3.2)
C1221	Resulfurized/Rephosphorized AISI 1211 (mod.)	0.020	0.102	0.090	0.112	0.876
1222	Cr–Ni–Mo (AISI 8640)	0.43	0.78	0.013	0.022	0.24
1224	Carbon (AISI 1078)	0.75	0.41	0.009	0.039	0.173
1225	Low Alloy (AISI 4130)	0.274	0.48	0.007	0.014	0.221
1226	Low Alloy	0.085	0.274	0.0022	0.0044	0.231
1227	Basic Open Hearth, 1% C	0.97	0.402	0.014	0.026	0.215
1228	0.1% C	0.072	0.365	0.004	0.018	0.007
1254	Low Alloy (Calcium only)	Ca **0.0053**				
1261a	AISI 4340	0.391	0.67	0.016	0.015	0.228
1262b	AISI 94B17	0.160	1.05	0.044	0.037	0.40
1263a	Cr–V (mod.)	0.57	1.50	0.029	0.0055	0.74
1264a	High Carbon (mod.)	0.871	0.258	0.010	0.025	0.066
1265a	Electrolytic Iron	0.0067	0.0057	0.0011	0.0055	0.0080
1269	Line Pipe (AISI 1526 mod.)	0.298	1.35	0.012	0.0061	0.189
1270	Cr–Mo Low Alloy, A336 (F–22)	0.077	0.626	0.0065	0.0065	0.247
1271	Ni–Cr–Cu–Mo (HSLA 100)	0.064	0.73	0.005	0.0013	0.334
C1285	Low Alloy (A242 mod.)	0.058	0.332	0.072	0.020	0.36
1286	Low Alloy (HY 80)	0.196	0.152	0.008	0.017	0.130
1761	Low Alloy Steel	1.03	0.678	0.040	0.035	0.18
1762	Low Alloy Steel	0.337	2.00	0.034	0.030	0.35
1763	Low Alloy Steel	0.203	1.58	0.012	0.023	0.63
1764	Low Alloy Steel	0.592	1.21	0.020	0.012	0.057
1765	Low Alloy Steel	0.006	0.144	0.0052	0.0038	(0.004)
1766	Low Alloy Steel	0.015	0.067	0.002	0.0024	0.010
1767	Low Alloy Steel	0.052	0.022	0.0031	0.0090	0.026
1768	High-Purity Iron	0.0010	0.0014	0.0013	0.0003	(<10.0)*

Values in parentheses are not certified and are given for information only.
*Value is in mg/kg.

101. Low Alloy Steels (disk and rod forms) – Continued

SRM	As	Sn	Al (total)	B	Pb	Ag	Ge
661	0.017	0.011	0.021	0.0005	0.000025	0.0004	[0.006]
663	0.010	(0.095)	0.024	0.0009	0.0022	(0.0038)	[0.010]
664	0.052	[0.005]	(0.008)	0.011	0.024	(0.00002)	[0.003]
665	(0.0002)	(<0.0005)	(0.0007)	0.00013	0.000015	(<0.00002)	(<0.0050)
1134		0.003	0.329				
1135		0.004	0.0028				
1218			0.005				
C1221			0.111				
1222			(0.038)				
1224			0.060				
1226		(0.003)	0.054		(0.0001)		
1227			(0.028)				
1228			0.061				
1261a	0.017	0.010	0.021		0.000025	0.0004	[0.006]
1262b	0.096	0.016	0.081	0.0025	0.0004	0.0011	[0.002]
1263a	0.010	0.104	0.24		0.0022	0.0037	[0.010]
1264a	0.052	(0.008)	(0.0080)	(0.011)	0.024	(0.000002)	[0.003]
1265a	(0.0002)	<2	(0.0007)	0.00013	0.000015	<0.2	<50
1269	(0.006)	(0.039)	0.016	(<0.0001)	0.005	(0.0002)	
1270	(0.02)	(0.02)	(0.005)	(0.0033)	(0.0016)	(0.0001)	
1271			0.020				
C1285	(0.022)	0.35	(0.12)				
1286	0.019	0.012	0.109	(0.006)	(0.0002)		
1761	0.011	(0.05)	0.06	0.0020			
1762	0.018	0.046	0.069	0.0049			
1763	0.055	0.011	0.043	0.0054			
1764	0.010	(0.02)	0.009	0.0010			
1765	0.0010	0.002	(0.006)	0.0009	0.0003	0.0002	
1766	0.0035	0.0010	0.012	0.00012	0.003	0.0005	
1767	0.0005	0.006	0.004	0.0010	(0.0001)	0.0008	
1768	(<1.0)*	(<1.0)*	0.0024	(<2.0)*	(<1.0)*		

SRM	O	N	H	Nb	Se	Ta	Zr
661	(0.0009)	(0.0037)	[<0.0005]	0.022	0.004	0.020	0.009
663	(0.0007)	(0.0041)	[<0.0005]	0.049	[0.0001]	(0.053)	0.050
664	[0.0017]	[0.003]	[<0.0005]	0.157	[0.0003]	0.11	0.069
665	(<0.0070)	(<0.0020)	(<0.0005)				
1218							(0.002)
C1221							(0.0017)
1222		(0.007)		(0.002)			(0.001)
1226				(0.005)			(0.010)
1227							(0.0006)
1261a	(0.0009)	(0.0037)	(<0.0005)	0.022	0.004	0.021	0.009
1262b	(0.0011)	(0.0040)	(<0.0005)	0.30	(0.0012)	0.20	0.22
1263a	(0.00066)	(0.0041)	(<0.0005)	0.049	(0.00016)	(0.053)	0.050
1264a	(0.0010)	(0.0032)	(<0.0005)	0.157	(0.00021)	0.11	0.069
1265a	<70	<20	<5				
1271				0.025			
C1285							(0.02)
1286				(0.012)			(0.021)
1761		0.0044		0.02		0.05	0.01
1762		0.0022		0.07		0.02	0.03
1763		0.0044		0.10		0.01	0.04
1764		0.0023		0.042		0.029	0.0015
1765		0.0010		0.0004	(0.0035)	(0.004)	(0.0002)
1766		0.0033		0.005	(0.0035)	(0.006)	(0.0004)
1767		0.0008		0.010		(0.002)	(0.004)
1768	0.036	0.002	Cd (<1.0)*	(<5.0)*	(<1.0)*	(<1.0)*	(<1.0)*

Values in parentheses are not certified and are given for information only.
Values in brackets are approximate values from heat analysis and are given for information only.
*Value is in mg/kg.

101. Low Alloy Steels (disk and rod forms) – Continued

SRM	Cu	Ni	Cr	V	Mo	W	Co	Ti
661	0.042	1.99	0.69	0.011	0.19	0.017	0.032	0.020
663	0.098	0.32	1.31	0.31	0.30	0.046	0.048	0.050
664	0.250	0.142	0.066	0.106	0.49	0.102	0.15	0.23
665	0.0058	0.041	0.007	0.0006	0.005	(<0.0001)	0.007	0.0006
1134	0.070	0.038	0.019		0.008			
1135	0.056	0.050	0.022	<0.01	0.014			
1218	0.003	(0.002)	0.006	(<0.001)	(0.003)		(0.002)	(0.004)
C1221	0.041	0.067	0.049	(0.0007)	0.038		(0.010)	(0.0014)
1222	0.097	0.51	0.48	0.005	0.18		(0.016)	(0.002)
1224	0.072	0.054	0.071	0.002	0.013			
1225		0.018	0.91	0.004	0.166			
1226	0.125	5.42	0.467	0.0018	0.446	(0.005)	0.029	0.0021
1227	0.006	0.007	0.019	0.002	0.003	0.003	(0.0008)	
1228	0.012	0.018	0.016	<0.001	0.009			
1261a	0.042	2.00	0.693	0.011	0.19	0.017	0.032	0.020
1262b	0.51	0.59	0.30	0.041	0.070	0.20	0.57	0.100
1263a	0.098	0.32	1.31	0.31	0.030	0.046	0.048	0.050
1264a	0.250	0.142	0.066	0.106	0.49	0.102	0.15	0.24
1265a	0.0058	0.041	0.0072	0.0006	0.0050	<1	0.0070	(0.0001)
1269	0.095	0.108	0.201	0.004	0.036	(0.001)	(0.014)	(0.009)
1270	0.114	0.174	2.34	0.013	0.956	(0.003)	0.038	(0.003)
1271	1.48	3.34	0.552	0.003	0.543			
C1285	0.37	1.17	0.80	0.150	0.164	(0.03)	0.036	**Ce (0.0021)**
1286	0.043	2.81	1.53	0.0057	0.334	(0.13)	0.116	0.040
1761	0.30	1.99	0.220	0.053	0.103	(0.02)	(0.028)	0.18
1762	0.120	1.15	0.92	0.200	0.35	(0.01)	0.062	0.095
1763	0.043	0.51	0.50	0.30	0.50	(0.03)	0.095	0.31
1764	0.51	0.202	1.48	0.106	0.200	(<0.01)	(0.01)	0.028
1765	0.0013	0.154	0.051	0.0040	0.005		0.0012	0.0055
1766	0.015	0.021	0.024	0.009	0.0035	(0.001)	0.0020	0.0005
1767	0.0014	0.002	0.0015	0.033	0.020		0.0050	0.011
1768	0.0006	0.0014	(<2.0)*	(<1.0)*	(<3.0)*	(<2.0)*	0.0025	(<10.0)*

SRM	Au	Ce	Hf	La	Nd	Pr	Fe
661	(<0.0005)	0.013	[0.00002]	0.0004	0.0003	(0.00014)	(95.6)
663	0.0005	(0.0016)	[0.0015]	0.0006	(0.0007)	(0.00018)	(94.4)
664	0.0001	(0.00025)	[0.005]	0.00007	(0.00012)	(0.00003)	(96.7)
665							99.9
1261a	(<0.00005)	0.0014	(0.0002)	0.0004	0.00029	(0.00014)	(95.6)
1262b	(0.00005)	0.0019	(0.0003)	(0.0004)	0.0006	(0.00012)	(95.3)
1263a	0.0005	0.0014	(0.0005)	0.0006	0.00060	(0.00018)	(94.4)
1264a	0.0001	0.00022	(0.0013)	0.00007	0.00007	(0.00003)	(96.7)
1265a							99.9
1764							(95.2)
1766		(0.002)					

Values in parentheses are not certified and are given for information only.
Values in brackets are approximate values from heat analysis and are given for information only.
*Value is in mg/kg.

101. Low Alloy Steels (disk and rod forms) – Continued

SRM	Sb	Bi	Ca	Mg	Te	Zn
661	0.0042	0.0004	(<0.0001)	(0.0001)	0.0006	(0.0001)
663	0.002	(0.0008)	(<0.0001)	(0.0005)	(0.0022)	(0.0004)
664	(0.035)	(0.0009)	(<0.0001)	(0.0001)	[0.0002]	[0.001]
665	(<0.00005)	(<0.00001)	(<0.00001)	(<0.00002)	(<0.00001)	(<0.0003)
1261a	0.0042	0.0004	0.00002	0.00018	0.0006	(0.0001)
1262b	0.012	(0.002)	(0.0001)	0.0006	(0.001)	(0.0005)
1263a	0.002	(0.0008)	0.00013	0.00049	0.0009	(0.0004)
1264a	0.034	(0.0009)	0.00004	0.00015	0.00018	[0.001]
1265a						<3
C1285	(0.04)					
1765	0.0010	(<0.0001)		(<0.0001)	(0.003)	
1766	0.0005	(<0.0001)		(<0.0005)	(0.003)	
1767		(<0.0001)	(0.0003)	(<0.0001)	(0.0003)	
1768	(<1.0)*	(<4.0)*	(<1.0)*	(<6.0)*	(<1.0)*	(<1.0)*

Values in parentheses are not certified and are given for information only.
Values in brackets are approximate values from heat analysis and are given for information only.
*Value is in mg/kg.

101. High Temperature Alloys (chip and disk forms)

SRM	Type	Unit Size (in g)	Elemental Composition (mass fraction, in %)					
			C	Mn	P	S	Si	Cu
866	Incoloy™ 800	100	0.082	0.92	0.017	0.001	0.17	0.49
867	Incoloy™ 825	100	0.021	0.39	0.018	0.002	0.32	1.74
1230	A 286	disk	0.044	0.64	0.023	0.0007	0.43	0.14
1246	Incoloy™ 800	disk	0.082	0.91	0.018	0.001	0.18	0.49
1247	Incoloy™ 825	disk	0.021	0.38	0.018	0.002	0.32	1.75
1250	Fe–Ni–Co	disk	0.022	0.052	<0.003	0.0025	0.097	0.022
C2400	High Alloy Steel, ACI (17/4 PH)	disk	0.036	0.71	0.013	0.003	0.61	2.63
C2401	High Alloy Steel (ACI–CD–4M Cu)	disk	0.062	1.03	0.025	0.027	0.74	3.17

SRM	Ni	Cr	Mo	Co	Ti	Al	Nb	Ta	Fe	W	B
866	30.8	20.1	0.36	0.075	0.31	0.29	(0.09)		46.1		<0.001
867	43.5	23.4	2.73	0.089	0.75	0.062	(0.45)		26.6		0.002
1230	24.2	14.8	1.18	0.15	2.12	0.24	(0.07)	**V 0.23**	(55)	(0.07)	0.0055
1246	30.8	20.1	0.36	0.076	0.32	0.30	(0.09)		46.2		<0.001
1247	43.5	23.4	2.73	0.089	0.75	0.060	(0.46)		26.5		0.002
1250	37.78	0.077	0.014	16.1	1.48	0.99	2.99	0.003	40.5	**V 0.077**	0.0078
C2400	4.07	17.06	0.23	0.10			0.15	**V 0.092**		(0.1)	(0.0004)
C2401	5.46	25.1	2.13	0.19			(0.002)	**V 0.20**		(0.18)	(0.0004)

Values in parentheses are not certified and are given for information only.

101. Stainless Steels (disk form)

SRM	Type	Elemental Composition (mass fraction, in %)							
		C	Mn	P	S	Si	Cu	Ni	Cr
C1151a	23Cr–7Ni	0.034	2.39	0.017	0.038	0.29	0.385	7.25	22.59
C1152a	18Cr–11Ni	0.142	0.95	0.023	0.0064	0.64	0.097	10.86	17.76
C1153a	17Cr–9Ni	0.225	0.544	0.030	0.019	1.00	0.226	8.76	16.70
C1154a	19Cr–13Ni	0.100	1.44	0.06	0.051	0.53	0.44	13.08	19.31
1155	Cr–Ni–Mo (AISI 316)	0.046	1.63	0.020	0.018	0.502	0.169	12.18	18.45
1171	Cr–Ni–Ti (AISI 321)	0.067	1.80	0.018	0.013	0.54	0.121	11.2	17.4
1172	Cr–Ni–Nb (AISI 348)	0.056	1.76	0.025	0.014	0.59	0.105	11.35	17.40
1219	Cr–Ni (AISI 431)	0.149	0.42	0.026	0.001	0.545	0.162	2.16	15.64
1223	Chromium Steel	0.127	1.08	0.018	0.329	0.327	0.081	0.232	12.64
C1287	High Alloy (AISI 310 mod.)	0.36	1.66	0.029	0.024	1.66	0.58	21.16	23.98
C1288	High Alloy (A–743)	0.056	0.83	0.023	0.010	0.41	3.72	29.3	19.55
1295	Cr (SAE 405)	0.027	0.387	0.022	0.0003	0.321	0.260	0.194	13.52
C1296	28Cr–3Mo (SAE 460)	0.038	0.256	0.024	0.013	0.66	0.056	0.373	27.90
1297	Cr–Ni–Mn (SAE 201)	0.066	7.11	0.038	0.0033	0.397	0.442	5.34	16.69

SRM	V	Mo	Co	Ti	N	Al	Nb	Ta	W	Pb	Zr
C1151a	0.040	0.79	0.033		(0.21)	(0.003)	(0.015)	(0.004)		0.0039	
C1152a	0.033	0.44	0.22		(0.055)	(0.004)	(0.15)	(0.001)		0.0047	
C1153a	0.176	0.24	0.127	(0.013)	(0.11)	(0.004)	(0.48)	(0.03)		0.006	(0.0001)
C1154a	0.135	0.068	0.38	(0.004)	(0.077)		(0.22)	(0.045)		0.017	(0.001)
1155	0.047	2.38	0.101							0.001	
1171		0.165	0.10	0.34							
1172		0.22	0.12				0.65	<0.001			
1219	0.056	0.164	(0.04)	(<0.001)	0.078	(0.001)	(0.01)	**Sn (0.008)**	(0.02)	(<0.0001)	**B (<0.001)**
1223	0.068	0.053	**Mg (<0.0005)**		(0.05)	(<0.005)		**Sn (0.004)**	**Ca (<0.0005)**		(0.0001)
C1287	0.09	0.46	0.31	0.050	(0.034)	(0.06)	(0.07)	**O (0.017)**		0.008	(0.006)
C1288	0.086	2.83	0.10	0.012	(0.028)	(0.0025)	(0.22)	**O (0.029)**	(0.2)	0.0041	(0.002)
1295	0.082	0.023	0.020	(0.01)	**Sn (0.02)**	(0.20)	(<0.0005)	(<0.001)	(0.002)	(0.0001)	**As (0.006)**
C1296	0.134	3.43	0.026	0.23	**Sn (<0.01)**	0.035	0.20	(<0.001)	(<0.01)	(<0.001)	**As (<0.01)**
1297	0.080	0.331	0.127	(<0.0004)	**Sn (<0.010)**	(0.003)	(<0.009)	(<0.001)	(0.03)	(<0.0001)	**As (0.005)**

Values in parentheses are not certified and are given for information only.

101. Specialty Steels (disk form)

SRM	Type	Elemental Composition (mass fraction, in %)											
		C	Mn	P	S	Si	Cu	Ni	Cr	V	Mo	W	Co
1157	Tool (AISI M2)	0.836	0.34	0.011	0.004	0.18	0.088	0.228	4.36	1.82	4.86	6.28	0.028
1158	High Nickel (Ni 36)	0.025	0.468	0.004	0.005	0.194	0.039	36.03	0.062	0.001	0.010		0.008
1233	Valve Steel	0.502	9.16	0.031	0.002	0.219	0.375	3.43	21.08	0.096	0.237	(0.01)	
1772	Tool (S-7)	0.447	0.61	0.008	0.0031	0.264	0.083	0.105	3.10	0.236	1.38		

101. Steelmaking Alloys (powder form)

These SRMs are for checking chemical methods of analysis for major constituents and selected minor elements. They are furnished as fine powders (usually <0.1 mm).

SRM	Type	Unit Size (in g)	Elemental Composition (mass fraction, in %)							
			C	Mn	P	S	Si	Cu	Ni	O
57a	Silicon Metal	60	0.024	0.015	0.003	0.003	98.55	0.004	0.008	(~0.3)
58a	Ferrosilicon (73% Si-Regular Grade)	75	0.014	0.16	0.009	<0.002	73.20	0.024	0.012	(0.20)
59a	Ferrosilicon	50	0.046	0.75	0.016	0.002	48.10	0.052	0.033	
64c	Ferrochromium, High Carbon	100	4.68	0.16	0.020	0.067	1.22	0.005	0.43	
68c	Ferromanganese, High Carbon	100	6.72	80.04	0.19	0.008	0.225			
90	Ferrophosphorus	75			26.2					
195	Ferrosilicon (75% Si-High-Purity Grade)	75	0.034	0.17	0.017	0.001	75.3	0.047	0.032	(0.42)
196	Ferrochromium, Low Carbon	100	0.035	(0.282)	0.020	0.003	0.373			
347	Magnesium Ferrosilicon	100	0.017	0.53	0.023	0.005	47.6	0.065	0.082	
689	Ferrochromium Silicon	100	0.043	0.32	0.026	0.002	39.5	0.013	0.20	(0.06)

SRM	Cr	V	Mo	Ti	Al	Nb	Zr	Ca	Fe	B	As
57a	0.024	0.013	**Pb<0.001**	0.040	0.47		0.002	0.17	0.50	0.001	<0.001
58a	0.020	(0.002)	(0.01)	0.051	0.95	**Co <0.01**	0.002	0.30	25.23	0.0010	(0.0020)
59a	0.080				0.35			0.042	50.05	0.058	
64c	68.00	0.15		0.02		**Co 0.051**		**N 0.045**	24.98		
68c	0.074								12.3		0.021
90											
195	<0.01	(0.001)	(0.01)	0.037	0.046	**Co <0.01**	0.011	0.053	23.6	0.0010	(0.0024)
196	70.83	(0.12)									
347	0.14			0.036	0.78		**Co 0.004**	0.81	**Mg 4.49**	**Ce 0.45**	**La 0.26**
689	36.4	0.09	Pb(0.004)	0.40	0.049	**Co 0.034**	**Bi (<0.003)**	**N (0.002)**	23.2	0.0017	(0.009)

Values in parentheses are not certified and are given for information only.

101. Cast Irons (chip form)

These SRMs are furnished in 150-g units (unless otherwise noted) for use in checking chemical methods of analysis.

SRM	Type	Elemental Composition (mass fraction, in %)							
		C		Mn	P	S		Si	Cu
		Total	Graphitic			Grav	Comb		
4L	Cast	3.21	2.66	0.825	0.149		0.043	1.33	0.240
5m	Cast	2.59		0.74	0.32		0.133	1.83	0.89
6g	Cast	2.85	2.01	1.05	0.557		0.124	1.05	0.502
7g	Cast (High Phosphorus)	2.69	2.59	0.612	0.794	0.061	0.060	2.41	0.128
82b	Cast (Ni–Cr)	2.85	2.37	0.745	0.025		0.007	2.10	0.038
107c	Cast (Ni–Cr–Mo)	2.99	1.98	0.480	0.079		0.059	1.21	0.205
115a	Cast (Cu–Ni–Cr)	2.62	1.96	1.00	0.086	0.064	0.065	2.13	5.52
122i	Cast	3.47		0.530	0.28		0.087	0.89	0.033
334	Gray Cast (Carbon & Sulfur)	2.83					0.043		
338	White Cast (Carbon & Sulfur)	3.33					0.015		
341	Ductile	1.81	1.23	0.92	0.024	0.007	0.007	2.44	0.152
342a	Nodular	1.86	1.38	0.274	0.019		0.006	2.73	0.135
890	HC 250+V	2.91		0.62	0.025		0.015	0.67	0.055
891	Ni–Hard, Type I	2.71		0.55	0.038		0.029	0.56	0.150
892	Ni–Hard, Type IV	3.33		0.76	0.054		0.015	1.83	0.270

SRM	Ni	Cr	V	Mo	Co	Ti
4L	0.042	0.118	0.024	0.040	**Zn(<0.001)**	(0.03)
5m	0.041	0.080	0.033	0.029		0.097
6g	0.135	0.370	0.056	0.035		0.059
7g	0.120	0.048	0.010	0.012		0.044
82b	1.22	0.333	0.027	0.002		0.027
107c	2.20	0.693	0.015	0.83		0.019
115a	14.49	1.98	0.014	0.050		0.020
122i	0.047	0.151	0.012	0.008		0.024
341	20.32	1.98	0.012	0.010		0.018
342a	0.058	0.034		0.006		0.020
890	0.397	32.4	0.45	0.018	(0.03)	
891	4.48	2.23	0.039	0.27	0.19	(0.01)
892	5.53	10.18	0.041	0.20	0.31	(0.02)

SRM	As	Sn	Al (total)	Mg	N	Fe
4L	(0.03)	(0.004)	(0.004)	**Sb (<0.001)**	(0.0016)	**Pb (0.001)**
5m					0.006	
6g	0.042				0.005	
7g	0.014				0.004	
341				0.068		
342a				0.070		
890	(0.008)		(<0.01)		(0.089)	(61.8)
891	(0.004)	(<0.01)	(0.008)		(0.012)	(88.5)
892	(0.006)	(0.02)	(0.009)		(0.019)	(77.4)

Values in parentheses are not certified and are given for information only.

101. Cast Steels, White Cast Irons, and Ductile Irons (disk form)

These SRMs are for analysis of cast steels and cast irons by rapid instrumental methods.

SRM	Type	Elemental Composition (mass fraction, in %)							
		C	Mn	P	S	Si	Cu	Ni	Cr
C1137a	White Cast Iron	2.86	0.52	0.087	0.017	1.15	0.192	2.17	0.643
1138a	Cast Steel (No. 1)	0.118	0.35	0.035	0.056	0.25	0.09	0.10	0.13
1139a	Cast Steel (No. 2)	0.790	0.92	0.012	0.013	0.80	0.47	0.98	2.18
C1145a	White Cast Iron	2.92	0.187	0.215	0.191	0.271	0.46	0.62	0.63
C1173	Cast Steel 3	0.453	0.174	0.031	0.092	1.38	0.204	4.04	2.63
1173	Ni–Cr–Mo–V Steel	0.423	0.19	0.033	0.092	1.28	0.204	4.06	2.70
C1290	High Alloy (HC–250+V)	3.04	0.66	0.030	0.013	0.971	0.065	0.917	30.5
C1291	High Alloy (Ni–Hard, Type I)	2.67	1.14	0.028	0.032	1.34	0.26	4.34	2.78
C1292	High Alloy (Ni–Hard, Type IV)	3.47	0.55	0.049	0.016	0.59	0.36	5.04	11.4
C2423	Ductile Iron A	3.76	0.98	0.27	(0.0006)	1.67	1.55	0.146	0.322
C2423a	Ductile Iron B	3.66	0.91	0.246	(<0.001)	1.59	1.61	0.147	0.322
C2424	Ductile Iron C	2.68	0.268	0.041	0.024	3.37	0.125	0.061	0.13
C2424a	Ductile Iron D	2.76	0.207	0.034	0.016	3.30	0.099	0.045	0.15

SRM	V	Mo	Ti	As	Al		Co
C1137a	0.019	0.86	(0.04)		(0.007)	**Mg 0.032**	**Ce0.016**
1138a	0.020	0.05	(0.0012)	(<0.005)	(0.067)	**Fe (98.7)**	
1139a	0.26	0.51	(0.004)	(<0.005)	(0.13)	**Fe (93.0)**	
C1145a	0.112	0.48	0.012	(0.02)	(0.04)		0.058
C1173	0.42	1.46	0.037	(0.02)	(0.005)	**Pb (0.0006)**	(0.064)
1173	0.42	1.50	(0.015)			**Nb (0.045)**	(0.064)
C1290	0.442	(0.041)					
C1291	0.031	0.32					
C1292	0.041	0.25					
C2423	0.048	0.155	0.10		(0.09)		(0.02)
C2423a	0.043	0.159	0.10		(0.08)		(0.02)
C2424	0.083	0.019	0.050		(<0.01)		(0.05)
C2424a	0.081	0.019	0.045		(<0.01)		(0.05)

SRM	Mg	Ce	La	B
C2423	0.058	0.036	0.011	(0.01)
C2423a	0.076	0.031	0.0042	(0.01)
C2424	0.006	0.0046	0.0011	(0.002)
C2424a	0.014	0.0053	0.0010	(0.001)

Values in parentheses are not certified and are given for information only.

102. Nonferrous Metals

Aluminum Base Alloys (chip and disk forms)

These SRMs are for analyses of casting and other aluminum alloys by chemical and instrumental methods. SRMs 1710 through 1719 are specially prepared to include low levels of cadmium and lead encountered in the analysis of recycled aluminum.

SRM	Type	Unit Size (in g)	Elemental Composition (mass fraction, in %)						
			Mn	Si	Cu	Ni	Cr	V	Cd
87a	Al–Si	75	0.26	6.24	0.30	0.57	0.11	<0.01	
855a	Casting Alloy 356	30	0.057	7.07	0.13	0.016	0.013	(0.012)	**Mn 0.060**
856a	Casting Alloy 380 (fine millings)	30	0.35	9.21	3.51	0.37	0.055		
858	Alloy 6011	35	0.48	0.79	0.84	0.0006	0.0011	0.0030	
859	Alloy 7075	35	0.078	0.17	1.59	0.063	0.176	0.0082	
1258	Alloy 6011	disk	0.48	0.78	0.84	0.0006	0.0011		
1259	Alloy 7075	disk	0.079	0.18	1.60	0.063	0.173		
1710	Alloy 3004	disk							0.000843
1711	Alloy 3004	disk							0.002090
1712	Alloy 3004	disk							0.005165
1713	Alloy 5182	disk							0.000878
1714	Alloy 5182	disk							0.002013
1715	Alloy 5182	disk							0.00502

SRM	Ti	Sn	Ga	Fe	Pb	Mg	Zn	Zr	Be
87a	0.18	0.05	0.02	0.61	0.10	0.37	0.16		
855a	0.15	0.010	**Sr 0.018**	0.14	0.019	0.37	0.085	(0.003)	**Ca (0.001)**
856a	0.068	0.10		0.92	0.10	0.061	0.96		
858	0.042			0.078		1.01	1.04		<0.0001
859	0.041			0.202		2.45	5.46		0.0026
1258	(0.04)		(0.010)	0.079		0.98	1.03		<0.0001
1259	(0.04)		(0.022)	0.205		2.48	5.44		0.0025
1710					0.00177				
1711					0.00639				
1712					0.01559				
1713					0.001712				
1714					0.00653				
1715					0.01509				

Values in parentheses are not certified and are given for information only.

102. Cobalt Base Alloys (chip and disk forms)

SRM	Type	Elemental Composition (mass fraction, in %)					
		C	Mn	P	S	Si	Cu
862	High Temperature Alloy L605—(chip) (**100 g**)	0.120	1.59	0.002	0.0008	0.017	0.0010
1242	High Temperature Alloy L605—(disk)	0.126	1.58	0.002	0.0007	0.016	0.0010

SRM	Ni	Cr	V	Fe	W	Co	N	Al	Ta	Nb	B
862	9.74	20.0	0.005	1.80	15.1	51.5	0.026	(<0.01)	(<0.01)	(<0.005)	(<0.0001)
1242	9.78	20.0	0.005	1.80	15.1	51.5	0.026	(<0.01)	(<0.01)	(<0.005)	(<0.0001)

Values in parentheses are not certified and are given for information only.

102. Copper Base Alloys (chip and rod forms)

SRM	Type	Unit Size (in g)	Elemental Composition (mass fraction, in %)				
			Cu	Ni	Fe	Zn	Pb
158a	Bronze, Silicon	150	90.93	0.001	1.23	2.08	0.097
458	Beryllium-Copper (17510)	50	(97.9)	1.60	0.060	0.002	0.002
459	Beryllium-Copper (17200)	50	(97.7)	0.039	0.079	0.002	0.001
460	Beryllium-Copper (17300)	50	(97.5)	0.031	0.098	0.004	0.258
871	Bronze, Phosphor (CDA 521)	100	91.68		<0.001	0.025	0.010
872	Bronze, Phosphor (CDA 544)	100	87.36		0.003	4.0	4.13
874	Cupro-Nickel, 10% (CDA 706) "High-Purity"	100	88.49	10.18	1.22	0.002	<0.0005
875	Cupro-Nickel, 10% (CDA 706) "Doped"	100	87.83	10.42	1.45	0.11	0.0092
879	Nickel Silver (CDA 762)	100	57.75	12.11	0.0020	30.04	0.002
880	Nickel Silver (CDA 770)	100	54.51	18.13	0.004	27.3	0.002
1034	Unalloyed Copper	rod	(99.96)	(0.6)*	(2.0)*	(<11)*	(0.5)*
1035	Leaded-Tin Bronze Alloy	50	(78.5)	(0.75)	(0.001)	(0.25)	(13.5)

SRM	Mn	Sb	Sn	Cr	P	Ag	Si	Al	Te	Cd	Se
158a	1.11		0.96		0.026		3.03	0.46			
458	(<0.002)	(<0.005)	0.004	0.004		(<0.01)	0.035	0.030			
459	(<0.003)	(<0.005)	0.005	0.005		(<0.003)	0.077	0.044			
460	(<0.003)	(<0.005)	0.006	0.005		(<0.002)	0.77	0.048			
871			8.14		0.082						
872			4.16		0.26						
874	0.0020	<0.001	0.007		0.002		(0.0006)			<0.0002	0.00015
875	<0.0007	<0.001	0.009		0.0020		(0.0008)		(<0.0001)	0.0022	0.0004
879	<0.001										
880	<0.001										
1034	(<0.1)*	(0.2)*	(<0.2)*	(0.3)*		(8.1)*	(<2)*	(<2)*	(0.5)*	(<1)*	(3.3)*
1035			(6.8)		(0.004)						

SRM	Bi	O	Co	C	Au	H	S	As	Mg	Ti
458			0.076	**Be 0.360**			(<0.002)	**Zr (<0.002)**	0.003	(<0.002)
459			0.221	**Be 1.82**			(<0.001)	**Zr (<0.002)**	0.007	(<0.003)
460			0.217	**Be 1.86**			(<0.001)	**Zr (<0.002)**	0.005	(<0.003)
874	<0.0002	(0.06)		(0.0023)		(0.0016)	(0.0011)	(<0.0006)	(0.0002)	(0.0001)
875	0.003	(0.14)		(0.0035)		(0.004)	(0.0011)	(0.0010)	(0.0010)	(<0.0002)
1034	(0.2)*	(363)*	(0.2)*		(<0.05)*		2.8*	(0.2)*	(<1*)	
1035		(0.64)					22.3**			

Values in parentheses are not certified and are given for information only.
*Value is in mg/kg.
**Sulfur value is in mg/kg.

102. Copper Base Alloys (block and disk forms)

The SRMs with a "C" prefix are chill-cast blocks, 31 mm square and 19 mm thick; the others are wrought disks, 31 mm in diameter and 19 mm thick. Both forms have nearly identical elemental compositions.

SRM		Type	Elemental Composition (mass fraction, in %)							
			Cu	Zn	Pb	Fe	Sn	Ni	Al	Sb
1104		Free-Cutting Brass	61.33	35.31	2.77	0.088	0.43	0.070		
1107		Naval Brass B	61.21	37.34	0.18	0.037	1.04	0.098		
1108		Naval Brass C	64.95	34.42	0.063	0.050	0.39	0.033		
1110		Red Brass B	84.59	15.20	0.033	0.033	0.051	0.053		
1111		Red Brass C	87.14	12.81	0.013	0.010	0.019	0.022		
1112	C1112	Gilding Metal A	93.38	6.30	0.057	0.070	0.12	0.100		
1113	C1113	Gilding Metal B	95.03	4.80	0.026	0.043	0.064	0.057		
1114	C1114	Gilding Metal C	96.45	3.47	0.012	0.017	0.027	0.021		
1115	C1115	Commercial Bronze A	87.96	11.73	0.013	0.13	0.10	0.074		
1116	C1116	Commercial Bronze B	90.37	9.44	0.042	0.046	0.044	0.048		
1117	C1117	Commercial Bronze C	93.01	6.87	0.069	0.014	0.021	0.020		
	C1122	Beryllium-Copper	97.45	(0.01)	(0.003)	0.16	(0.01)	(0.01)	0.17	
1276a		Cupro-Nickel (CDA 715)	67.8	0.038	0.004	0.56	0.023	30.5		0.0004

SRM		Be	Cd	Mn	P	Si	Ag
1104					0.005		
	C1106			0.005			
1108	C1108			0.025			
1112	C1112				0.009		
1113	C1113				0.008		
1114	C1114				0.009		
1115	C1115				0.005		
1116	C1116					0.008	
1117	C1117				0.002		
	C1122	1.75		(0.004)	(0.004)	0.17	(0.005)
1276a			0.0002	1.01	0.006		

SRM		Co	Cr	Se	Mg
	C1122	0.220	(0.002)		
1276a		0.045		0.0005	0.12

Values in parentheses are not certified and are given for information only.

102. Copper "Benchmark" (chip and rod forms)

[150-g units (unless otherwise noted)]

SRM		Type	Cu (mass fraction, in %)	Elemental Composition (in mg/kg)							
Chip	Rod			Sb	As	Bi	Cr	Co	Fe	Pb	Mn
393		Unalloyed Copper "O"	99.998	0.25	0.41	<0.1	<0.5	0.02	<1	0.039	<0.01
	494	Unalloyed Copper I	99.908	4.5	2.6	0.35	2.0	0.5	147	26.5	3.7
395	495	Unalloyed Copper II	99.944	8.0	1.6	0.50	6.0		96	3.25	5.3
396	496	Unalloyed Copper III	99.955	<1	<0.2	0.07	4.3	0.4	143	0.41	7.5
	457	Unalloyed Copper IV	99.96	0.2	0.2	0.2	(0.3)	(0.2)	2.0	0.5	<0.1
398		Unalloyed	99.98	7.5	25	2.0	(0.3)	2.8	11.4	9.9	(0.3)
	498	Copper V	99.98	7.4	25	2.0	(0.3)	2.7	11	10	(0.3)
399	499	Unalloyed Copper VI	99.79	30	47	10.5	(0.5)	0.5	20.0	114	(0.3)
400	500	Unalloyed Copper VII	99.70	102	140	24.5	(0.5)	0.6	41	128	(0.2)
	C1252	Phosphorized Copper IX	99.89	42	115	21	7.4	90	(35)	60	(17)
454 (**35 g**)		Unalloyed Copper XI	99.84	24	46	19		(4)	(50)	66	

SRM		Ni	Se	Ag	S	Te	Sn	Zn	Al	Cd	Au	Mg
393		0.05	<0.05	0.10	<1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1
	494	11.7	2.00	50.5	15	0.58	70	405	(<2)	(0.5)	(0.07)	(<1)
395	495	5.4	0.63	12.2	13	0.32	1.5	12.2	(<2)	(0.4)	(0.13)	(<1)
396	496	4.2	0.62	3.30	9.5	(0.02)	0.8	5.0	(<2)	(0.6)	(<0.05)	(<1)
	457	0.6	4.2	8.1	(4)	0.29	<0.2	<11	(<2)	(<1)	(<0.05)	(<1)
398		7.0	17.5	20.1	(11)	10.1	4.8	24	(<2)	(22)	(0.1)	(<1)
	498	7.0	17.5	20.1	(11)	10.1	5	25	(<2)	(<22)	(0.1)	(<1)
399	499	506	95	117	(10)	50	(~90)	45	(<2)	(<1)	(4)	(<1)
400	500	603	214	181	(9)	153	(~200)	114	(<2)	(<1)	(10)	(<1)
	C1252	128	53.6	166.6	(29)	51	(110)	60	(7)	14	34.9	(20)
454		(150)	479	286		27	2.2	7			7.5	

SRM		Si	Be	B	Ca	Li	Pd	P	Ti	Zr
393	494	<0.5	<0.01	<0.01	<0.05	<0.01	<0.05	<0.05	<0.5	<0.5
	494	(<2)								
395	495	(<2)								
396	496	(<2)								
398		(<2)								
	498	(<2)								
399	499	(<2)								
400	500	(<2)								
	C1252	(13)	(<5)		(6)	(0.03)				
454							(0.1)			

Values in parentheses are not certified and are given for information only.

The following four series of SRMs were produced through a cooperative program between NIST and the Institute for Non-Ferrous Metals (IMN), Gliwice, Poland and funded under the auspices of the Second Maria Sklodowska-Curie Fund. Development, characterization and certification of these brasses were carried out by IMN; homogeneity testing was performed by NIST. SRMs 1776 through 1280 are in the form of disks approximately 39.5 mm diameter and 20 mm thick; SRMs 1781 through 1785 are in the form of disks 39 mm diameter and 19 mm thick; SRMs 1786 through 1790 are in the form of disks 39 mm diameter and 25 mm thick; SRMs 1791 through 1795 are in the form of disks 38 mm diameter and 24 mm thick.

NOTE: Certification data for the Free Cutting Brasses, and Gilding Metals are concurrently undergoing review at the IMN and NIST. Therefore, when the Certificates of Analysis for these materials are issued, the actual certified values may differ from the "projected" values listed below.

102. Naval Brass (disk form)

SRM	Type	Elemental Composition (mass fraction, in %)				
		Cu	Pb	Fe	Sn	Ni
1776	Naval Brass WK1	59.97	0.17	0.28	0.11	0.28
1777	Naval Brass WK2	60.56	0.33	0.16	1.34	0.21
1778	Naval Brass WK3	62.10	0.11	0.06	0.49	0.13
1779	Naval Brass WK4	63.28	0.05	0.08	1.04	0.07
1780	Naval Brass WK5	64.92	0.006	0.01	0.47	0.005

SRM	Al	Sb	Mn	P	Si	Bi
1776	0.11	0.024	0.12	0.030	0.30	0.014
1777	0.08	0.019	0.09	0.018	0.23	0.012
1778	0.04	0.013	0.04	0.018	0.15	0.009
1779	0.01	0.006	0.02	0.011	0.08	0.005
1780	0.004	0.002	0.006	0.006	0.006	0.001

102. Free Cutting Brass (disk form) [See Note above.]

SRM	Type	Elemental Composition (mass fraction, in %)					
		Pb	Sn	Mn	Al	Fe	Si
1781	Free Cutting Brass WN1	0.51	1.00	0.57	0.33	0.23	0.16
1782	Free Cutting Brass WN2	1.58	0.68	0.73	0.24	0.29	0.22
1783	Free Cutting Brass WN3	2.62	0.39	0.39	0.14	0.062	0.12
1784	Free Cutting Brass WN4	0.86	0.13	0.13	0.047	0.11	0.036
1785	Free Cutting Brass WN5	3.78	0.019	0.0020	(0.0004)	0.0085	(0.0013)

SRM	P	Sb	Bi	As	Ni	Cu
1781	0.031	0.099	0.023	0.035	0.050	57.97
1782	0.051	0.10	0.035	0.011	0.19	60.38
1783	0.034	0.020	0.020	0.032	0.098	62.32
1784	0.014	0.061	0.0094	0.021	0.050	57.97
1785	0.0051	0.0035	0.0028	0.030	0.0049	64.36

102. Cartridge Brass (disk form) [See Note above.]

SRM	Type	Elemental Composition (mass fraction, in %)						
		Fe	Pb	Ni	Mn	Cd	Sb	Sn
1786	Cartridge Brass MH1	0.017	0.0065	0.26	0.035	0.026	0.0004	0.14
1787	Cartridge Brass MH2	0.027	0.021	0.22	0.011	0.018	0.024	0.097
1783	Cartridge Brass MH3	0.081	0.078	0.10	0.085	0.0089	0.013	0.024
1788	Cartridge Brass MH4	0.13	0.33	0.052	0.0017	0.0029	0.017	0.011
1780	Cartridge Brass MH5	0.19	0.20	0.0072	0.072	0.0012	0.0035	0.0021

SRM	Ag	As	Bi	P	S	Al	Te	Be	Si	Cu
1786	0.0029	0.067	0.0037	0.016	(0.0020)	0.0010	0.0004	0.0088	0.074	65.93
1787	0.011	0.041	0.0022	0.0055	(0.0068)	0.019	0.0015	0.0015	0.054	68.25
1788	0.0065	0.016	0.0011	0.0035	(0.013)	0.0081	0.0046	0.0003	0.031	71.28
1789		0.0011	0.0006	0.0022	(0.0054)	0.0027	0.0035	0.0045	0.016	69.94
1790	0.025	0.0038		0.0011	(0.025)	0.014	0.0047	0.00004	0.0039	72.87

102. Gilding Metal (disk form) [See Note on previous page.]

SRM	Type	Elemental Composition (mass fraction, in %)						
		Fe	Pb	Ni	Mn	Cd	Sb	Sn
1791	Gilding Metal MI1	0.25	0.0060	0.0059	0.0030	0.023	0.000044	0.15
1792	Gilding Metal MI2	0.16	0.016	0.018	0.0081	0.016	0.0019	0.10
1793	Gilding Metal MI3	0.086	0.042	0.073	0.035	0.011		0.067
1794	Gilding Metal MI4	0.041	0.070	0.14	0.050	0.0054	0.00067	0.013
1795	Gilding Metal MI5	0.015	0.096	0.25	0.069	0.0012	0.0096	0.0040

SRM	Ag	As	Bi	P	S	Al	Te	Be	Si	Zn	Cu
1791	0.0038	0.072	0.00063	0.028	0.043	0.040	0.0065	0.000091	0.0032	3.57	95.69
1792	0.0090	0.054	0.00056	0.022	0.049	0.055	0.011	0.00085	0.012	6.19	93.35
1793	0.020	0.034	0.0026	0.015	0.023	0.015	0.0031	0.0019	0.031	8.01	91.46
1794	0.026	0.0031	0.0026	0.0073	0.012	0.0079	0.0021	0.0065	0.060	11.13	88.35
1795	0.033	0.015	0.0043	0.0026	0.0019	0.0021		0.0072	0.082	4.44	94.71

102. Lead Base Alloys (chip and disk forms)
[150-g units (unless otherwise noted)]

SRM		Type	Elemental Composition (mass fraction, in %)							
Chip	Disk		Cu	Ni	As	Sn	Sb	Bi	Ag	Fe
1129 (200 g)		Solder 63Sn–37Pb	0.16	0.010	0.055	62.7	0.13	0.13	0.075	
127b	1131	Solder 40Sn–60Pb	0.011	0.012	0.01	39.3	0.43	0.06	0.01	
53e	1132	Bearing Metal(Pb–Sb–Sn)	0.054	0.003	0.057	5.84	10.26	0.052		<0.001

102. Lead Base Material (disk form)

These SRMs are issued in the form of disks, 50 mm in diameter and 16 mm thick. They are intended for use with optical emission spectrometric methods of analysis.

SRM	C2415	C2416	C2417	C2418
Type	Battery Lead	Bullet Lead	Lead Base Alloy	High Purity Lead
	Elemental Composition (mass fraction, in %)			
Sb	2.95	0.79	0.010	(<0.0001)
As	0.20	0.056	0.011	(<0.0001)
Bi	0.054	0.10	0.010	(<0.0005)
Cu	0.095	0.065	0.010	(<0.0001)
S	0.0026	0.0015	(<0.0005)	
Ag	0.002	0.0044	0.010	0.0001
Sn	0.33	0.09	(<0.010)	(<0.0005)
Al	(<0.0003)	(<0.0001)	(<0.0001)	(<0.0001)
Cd	0.002	(0.0002)	(<0.0002)	0.0003
Ca	(<0.001)	(<0.001)	(<0.001)	(<0.0005)
Co		(<0.0002)	(<0.0002)	(<0.0005)
Fe	<0.001	(<0.0005)	(<0.0003)	(<0.0005)
Mn	<0.001	(<0.0005)	(<0.0003)	(<0.0005)
Ni	<0.001	(<0.0005)	(<0.0005)	(<0.0005)
Te	0.0045	(<0.0005)	(<0.0005)	(<0.0005)
Zn	<0.001	(<0.0005)	(<0.0005)	(<0.0005)

Values in parentheses are not certified and are given for information only.

102. Nickel Base Alloys (chip and disk forms)

SRM	Type	Unit Size (in g)	Elemental Composition (mass fraction, in %)							
			C	Mn	P	S	Si	Cu	Ni	Cr
349a	Waspaloy™ Ni–Co–Cr	150	0.035	0.019	0.003	0.0024	0.018	0.007	58.1	19.3
864	Inconel™ 600	100	0.064	0.29	0.010	0.003	0.12	0.26	73.1	15.7
865	Inconel™ 625	100	0.037	0.18	0.012	0.001	0.41	0.36	59.5	21.9
882	Ni–Cu–Al	100	0.006	0.0007		0.0014	0.006	31.02	65.25	
1159	Electronic and Magnetic Alloy Ni–Fe	disk	0.007	0.305	0.003	0.003	0.32	0.038	48.2	0.06
1160	Electronic and Magnetic Alloy Ni–Mo	disk	0.019	0.550	0.003	0.001	0.37	0.021	80.3	0.05
1243	Waspaloy™	disk	0.024	0.019	0.003	0.0018	0.018	0.007	58.78	19.20
1244	Inconel™ 600	disk	0.062	0.29	0.010	0.003	0.12	0.26	73.2	15.7
1245a	Inconel™ 625	disk	0.037	0.18	0.012	0.001	0.41	0.37	59.7	22.0
C1248	Ni–Cu	disk	0.266	0.31	0.002	0.0008	1.61	29.80	65.75	0.095
1249	Inconel™ 718	disk	0.038	0.109	0.013		0.106	0.145	53.3	18.5
C2402	Hastelloy™ C	disk	0.010	0.64	0.007	0.018	0.85	0.19	51.5	16.15

SRM	Mo	Co	Ti	Al	B	Fe	Ta	V	Nb	W
349a	4.25	12.46	3.06	1.23	0.005	1.15		0.12		
864	0.20	0.059	0.26	0.26	<0.005	9.6			(0.14)	
865	8.6	0.072	0.28	0.21	<0.001	4.5			3.5	
882			0.57	2.85		0.009				
1159	0.010	0.022				51.0				
1160	4.35	0.054				14.3				
1243	4.25	12.46	3.06	1.23	0.005	0.79		0.12		
1244	0.20	0.058	0.25	0.26	<0.05	9.6			(0.14)	
1245a	8.5	0.071	0.28	0.19		4.5	<0.01		3.5	<0.001
C1248	0.006	**Pb 3.8 mg/kg**	**Sn 1.1 mg/kg**	0.009		2.10			**Zn 3 mg/kg**	
1249	3.09	0.325	0.957	0.563				0.034	5.19	
C2402	17.1	1.50	**Sn (0.001)**		(0.0004)	7.3		0.22	(<0.01)	4.29

Values in parentheses are not certified and are given for information only.

102. Trace Elements in Nickel Base Superalloys (chip form)

SRM	Type	Unit Size (in g)	Trace Composition (in mg/kg)				
			Pb	Bi	Se	Te	Tl
897	"Tracealloy" A	35	11.7	(0.5)	9.1	1.05	0.51
898	"Tracealloy" B	35	2.5	(1.0)	2.00	0.54	2.75
899	"Tracealloy" C	35	3.9	(0.3)	9.5	5.9	0.252

SRM	Base Composition (mass fraction, in %)											
	C	Cr	Co	Ni	W	Nb	Al	Ti	B	Zr	Ta	Hf
897, 898, 899	(0.12)	(12.0)	(8.5)	(Bal)	(1.75)	(0.9)	(2.0)	(2.0)	(0.010)	(0.10)	(1.75)	(1.2)

Values in parentheses are not certified and are given for information only.

102. Nickel Oxides (powder form)

SRM	Type	Unit Size (in g)	Elemental Composition (mass fraction, in %)								
			Mn	Si	Cu	Cr	Co	Ti	Al	Fe	Mg
671	Oxide 1	25	0.13	0.047	0.20	0.025	0.31	0.024	0.009	0.39	0.030
672	Oxide 2	25	0.095	0.11	0.018	0.003	0.55	0.009	0.004	0.079	0.020
673	Oxide 3	25	0.0037	0.006	0.002	0.0003	0.016	0.003	0.001	0.029	0.003

SRM	Trace Composition (in mg/kg)											
	Pb	Se	Bi	As	Sn	Sb	Cd	Ga	Ag	Te	Tl	Zn
671	16	2.0	0.07	(59)	(2.7)	(0.4)	(0.7)	(0.8)	(0.5)	(<0.2)	(<0.1)	(160)
672	38	0.40	0.3	(74)	(4)	(0.5)	(1.7)	(0.4)	(0.3)	(<0.2)	(<0.1)	(140)
673	3.5	0.2	0.06	(0.4)	(<0.5)	(<0.5)	(0.05)	(<0.1)	(<0.1)	(0.4)	(<0.1)	(1.7)

Values in parentheses are not certified and are given for information only.

102. Tin Base Alloys (chip form)

SRM	Type	Unit Size (in g)	Elemental Composition (mass fraction, in %)								
			Pb	Sn	Sb	Bi	Cn	Fe	As	Ag	Ni
54d	Bearing Metal	170	0.62	88.57	7.04	0.044	3.62	0.027	0.088	0.0032	0.0027

102. Titanium Base Alloys (chip and disk forms)

SRM	Type	Unit Size (in g)	Elemental Composition (mass fraction, in %)				
			C	Mn	Cr	Cu	Mo
173b	Al–V	50	0.025			0.008	0.013
641	8 Mn (A)	disk		6.68			
642	8 Mn (B)	disk		9.08			
643	8 Mn (C)	disk		11.68			
647	Al–Mo–Sn–Zr	50	0.006				1.96
648	Al–Sn–Zr–Cr–Mo	50	0.011		3.84		3.75
649	V–Al–Cr–Sn	50	0.011	(<0.01)	2.96	(<0.001)	
650	Unalloyed A	30		0.016	0.002	0.033	0.002
651	Unalloyed B	30		0.005	0.037	0.032	0.031
652	Unalloyed C	30		0.046	0.082	0.081	0.039
654b	Al–V	disk			(0.025)	0.004	(0.013)
1128	V–Al–Cr–Sn	disk	0.011	(<0.01)	2.96	(<0.003)	(0.006)
2431	6Al–2Sn–4Zr–6Mo	50	0.006	(<0.01)	(<0.01)	(<0.01)	6.01
2432	10V–2Fe–3Al	50	0.008	(<0.01)	(<0.01)	(<0.005)	
2433	Al-Mo-V	50					0.99

SRM	Fe	Al	V	Sn	Si	N	W	Zr
173b	0.23	6.36	4.31	(0.03)	0.046	0.015		
647	0.075	5.88	(<0.02)	2.02		(<0.01)		3.90
648	0.15	5.13		1.98	0.027	(0.01)		1.84
649	0.133	3.08	15.1	3.04		(0.01)		
650	0.024	<0.01	0.009	0.03	0.004		1.55	
651	0.058	<0.006	0.021	0.026	0.011		0.39	
652	0.67	0.039	0.024	0.053	0.16		0.5	
654b	0.023	6.34	4.31	0.023	0.045		**Ni 0.028**	0.008
1128	0.134	3.06	15.13	3.04		(0.01)		
2431	0.056	5.73	(<0.01)	1.98	0.088	**Ni (<0.01)**	(<0.001)	4.06
2432	1.77	3.15	10.00	**B (<0.001)**	0.029	**Ni (<0.01)**	(<0.001)	(<0.01)
2433	0.063	7.63	0.98					

Values in parentheses are not certified and are given for information only.

102. Zinc Base Alloys (chip and disk forms)

SRM	Type	Unit Size (in g)	Elemental Composition (mass fraction, in %)							
			Cu	Al	Mg	Fe	Pb	Cd	Sn	Cr
94c	Die Casting Alloy	150	1.01	4.13	0.042	0.018	0.006	0.002	0.006	
625	Zinc-base A–ASTM AG 40A	disk	0.034	3.06	0.070	0.036	0.0014	0.0007	0.0006	0.0128
626	Zinc-base B–ASTM AG 40A	disk	0.056	3.56	0.020	0.103	0.0022	0.0016	0.0012	0.0395
627	Zinc-base C–ASTM AG 40A	disk	0.132	3.88	0.030	0.023	0.0082	0.0051	0.0042	0.0038
628	Zinc-base D–ASTM AC 41A	disk	0.611	4.59	0.0094	0.066	0.0045	0.0040	0.0017	0.0087
629	Zinc-base E–ASTM AC 41A	disk	1.50	5.15	0.094	0.017	0.0135	0.0155	0.012	0.0008
630	Zinc-base F–ASTM AC 41A	disk	0.976	4.30	0.030	0.023	0.0083	0.0048	0.0040	0.0031
631	Zinc spelter (mod.)	disk	0.0013	0.50	(<0.001)	0.005	(0.001)	0.0002	0.0001	0.0001

SRM	Mn	Ni	Si	In	Ga	Ca	Ag	Ge
94c	0.014	0.006						
625	0.031	0.0184	0.017					
626	0.048	0.047	0.042					
627	0.014	0.0029	0.021					
628	0.0091	0.030	0.008					
629	0.0017	0.0075	0.078					
630	0.0106	0.0027	0.022					
631	0.00015	(<0.0005)	(0.002)	0.0023	(0.002)	<0.001	(<0.0005)	(0.0002)

Values in parentheses are not certified and are given for information only.

102. Zirconium Base Alloys (chip and disk forms)

SRM	Type	Unit Size (in g)	Elemental Composition (mass fraction, in %)										
			C	Mn	Hf	Cu	Ni	Cr	Ti	Sn	Fe	N	Al
360b	Zircaloy–4	100	0.011	0.0010	0.008	0.002	0.0025	0.10	0.002	1.55	0.21	0.0045	0.004

102. Gases in Metals (platelet form)

SRM	Type	Hydrogen (in mg/kg)
352c	Unalloyed Titanium for Hydrogen	49

103. Microanalysis

Metals (rod and wire forms)

SRM	Type	Elemental Composition (mass fraction, in %)				
		Au	Cu	Ag	W	Mo
480	Tungsten–20% Mo Alloy				78.5	21.5
481	Au 100 A	100.00				
	Au–20% Ag B	80.05		19.96		
	Au–40% Ag C	60.05		39.92		
	Au–60% Ag	40.03		59.93		
	Au–80% Ag E	22.43		77.58		
	Ag 100 F			100.00		
482	Au 100 A	100.00				
	Au–20% Cu B	80.15	19.83			
	Au–40% Cu C	60.36	39.64			
	Au–60% Cu	40.10	59.92			
	Au–80% Cu E	20.12	79.85			
	Cu 100 F		100.00			

103. Synthetic Glasses (rod form)

	SRM 1872			SRM 1873		
	Glass			Glass		
	K–453	K–491	K–968	K–458	K–489	K–963
	Elemental Composition (mass fraction, in %)					
Pb	54.21	54.69	54.74		(1.32)	
Si		(0.11)		23.05	(22.23)	(21.96)
Ge	28.43	26.10	25.93			(0.47)
Ba			(0.46)	41.79	39.53	39.21
Zn				3.01	2.93	2.95
P			(0.21)			(0.33)
Mg			(0.22)			(0.34)
Al		(0.10)			(0.11)	
B						
Zr		(0.26)	(0.48)		(0.40)	(0.61)
Ti		(0.14)	(0.16)		(0.27)	(0.32)
Ce		(0.59)			(0.80)	
Ta		(0.52)			(0.95)	
Fe		(0.17)			(0.35)	
Li						
Ni			(0.20)			(0.33)
Eu			(0.64)			(0.95)
U			(0.05)			(0.16)
Th			(0.12)			(0.06)
Cr			(0.19)			(0.31)
O	(16.73)	(16.45)	(16.67)	(31.86)	(31.70)	(32.00)
Total	(99.37)	(99.13)	(100.07)	(99.71)	(100.59)	(100.00)

Values in parentheses are not certified and are given for information only.

103. Thin Film for Transmission Electron Microscope

SRM	Type	Elemental Composition (mass fraction, in %)					
		Mg	Si	Ca	Fe	O	Ar
2063a	Mineral glass	7.97	25.34	11.82	11.06	43.2	(0.4)

Values in parentheses are not certified and are given for information only.

104. High Purity Materials

High Purity Metals (solid forms)

These SRMs are for determining impurity elements in high purity metals.

SRM	Type	Unit Size	Elemental Composition (in mg/kg)				
			Cu	Ni	Sn	Pb	Zr
680a	High Purity Platinum (Wire)	0.51 mm: L1 (10 cm)	0.1	<1		<1	<0.1
		0.51 mm; L2 (1 m)	0.1	<1		<1	<0.1
682	High Purity Zinc	semicirc 57 mm	0.042	(<0.1)	(0.02)		
683	Zinc Metal	semicirc 57 mm	5.9		(0.02)	11.1	
685R	High Purity Gold (Rod)	5.9 mm × 25 mm long	0.1	(<0.05)	(<0.07)		
685W	High Purity Gold (Wire)	1.4 mm × 102 mm long	0.1	(<0.05)	(<0.07)		
726	Selenium, Intermediate Purity	shot, 450 g	<1	<0.5	<1	<1	**Mn<0.3**
728	Zinc, Intermediate Purity	shot, 450 g	5.68	(0.45)	0.02	11.13	(<0.01)
*885	Refined Copper	pin, 200 g		<0.0001	<0.0001	0.0002	

SRM	Ag	Mg	In	Fe	O	Pd	Au	Rh	Ir	Cd	Tl
680a	<0.1	<1		1.3	4	0.2	<1	<0.2	<0.01		
682	(0.02)	(<0.1)		(0.1)	(<0.5)					(0.1)	
683	1.3			2.2						1.1	(0.2)
685R	[0.1]	(<0.2)	0.007	0.2	(<2)						
685W	[0.1]	(<0.2)	0.007	0.3	(2)						
726	<1	<1	**S 12**	1	**Cr<1**	**Mo<0.3**	**Te 0.3**	**As<2**	**Al <1**	**B<1**	**Ca<1**
728	1.08	(<0.001)	(<0.0005)	1.84		(<0.05)	(<0.02)	(<0.05)	(<0.005)	1.14	0.2
*885	0.0005			<0.0005	0.031		**S 0.0018**	**Sb<0.0002**	**As <0.0002**	**Bi<0.0001**	**Zn<0.0001**

Values in parentheses are not certified and are given for information only.
Values in brackets are subject to greater error since only one method of analysis was employed.
*SRM 885 values are mass fractions, in %.

104. Royal Canadian Mint Reference Materials (solid forms)

These RMs are a series each of fine silver, fine gold, and gold bullion products developed and certified by the Royal Canadian Mint (RCM), Ottawa, Canada and distributed by NIST. The fine silver and fine gold RMs are primarily intended for use as calibration standards for the determination of trace elements by solid sample spectrometric methods; the gold bullion RMs are primarily intended for use as quality control check standards for fire assay. There are four RMs in the fine silver series, five RMs in the gold bullion series, and six RMs in the fine gold series. The RMs in the fine silver series are available only in block form (24 mm × 24 mm × 5 mm). The RMs in the gold bullion series are available in three forms—disc (25 mm dia. × 20 mm), wire (2 mm dia.), and foil (35 mm × 40+mm × 1 mm). The RMs in the fine gold series are available in three forms — block (25 mm × 25 mm × 2.5 mm), wire (2 mm dia.), and turnings (25 g).

104. Royal Canadian Mint Reference Materials (solid forms) – Continued

RM	8162	8165	8168	8171
Type	Fine Silver	Fine Silver	Fine Silver	Fine Silver
Block Form	B	B	B	B
Unit Size (in g)	30	30	30	30
Components (in mg/kg)				
Bi	65.3	83.5	28.9	75.1
Cu	40.1	61.6	101	65.2
Fe	25.0	35.6	15.4	48.9
Au	52	15.0	75.0	26.7
Pb	18.1	59.1	125	38.8
Ni	27.4	35.0	13.5	57.0
Pd	41.8	64.3	11.7	27.3
Pt	17.3	17.9	24.4	12.3
Se	55.8	32.2	3.9	44.4
Te	62.9	(41.8)	6.6	25.8
Sn	21.7	54.1	10.3	46.1
Zn	(3.8)	18.6	8.3	7.2

Values in parentheses are not certified and are given for information only.

RM	8068/8069/8070			8071/8072/8073			8074/8075/8076			8077/8078/8079			8080/8081/8082		
Type	Gold Bullion			Gold Bullion			Gold Bullion			Gold Bullion			Gold Bullion		
Form (Disc, Wire, Foil)	D	W	F	D	W	F	D	W	F	D	W	F	D	W	F
Unit Size (in g)	30	25	25	30	25	25	30	25	25	30	25	25	30	25	25
Components (mass fraction, in %)															
Au	94.847			89.928			84.905			79.962			74.988		
Ag	4.15			8.03			12.08			15.09			15.04		
Cu	(1)			(2)			(3)			(5)			(10)		

Values in parentheses are not certified and are given for information only.

RM	8050/8051/8052			8053/8054/8055			8056/8057/8058			8059/8060/8061			8062/8063/8064			8065/8066/8067		
Type	Fine Gold			Fine Gold			Fine Gold			Fine Gold			Fine Gold			Fine Gold		
Form (Block, Wire, Turnings)	B	W	T	B	W	T	B	W	T	B	W	T	B	W	T	B	W	T
Unit Size (in g)	30	25	25	30	25	25	30	25	25	30	25	25	30	25	25	30	25	25
Components (in mg/kg)																		
As	2.4			10.0			18.0			6.7			29.4			14.3		
Bi	3.4			24.0			34.0			6.8			53.9			11.0		
Cr	1.7			32.6			13.3			5.0			4.9			16.7		
Cu	1.6			98.1			46.9			5.7			9.8			13.8		
Fe	6.2			11.6			33.8			7.5			90.4			15.4		
Pb	1.9			21.9			30.5			6.4			49.7			11.5		
Mg	1.1			34.0			11.8			6.0			3.2			15.6		
Mn	1.1			58.9			22.5			10.8			64.3			20.5		
Ni	2.7			32.5			50.5			5.7			14.6			13.5		
Pd	1.3			43.1			19.8			5.0			119			13.1		
Pt				87.1			40.8			6.1			5.1			12.5		
Si				2.7			27.8			6.3			9.0			19.1		
Ag	9.5			20.3			81.7			7.1			49.7			15.1		
Sn	2.8			33.8			27.2			6.4			49.7			17.8		
Ti	0.7			12.7			25.3			5.9			2.6			16.5		
Zn	2.6			54.6			6.6			7.5			20.9			12.5		

104. Stoichiometry (powder form)

These SRMs are defined as primary, working, and secondary standards in accordance with recommendations of the Analytical Chemistry Section of the International Union of Pure and Applied Chemistry [Ref. Analyst **90**, 251 (1965)]. These definitions are as follows:

Primary Standard:
a commercially available substance of purity 100 ± 0.02 % (Purity 99.98+ %).

Working Standard:
a commercially available substance of purity 100 ± 0.05 % (Purity 99.95+%).

Secondary Standard:
a substance of lower purity which can be standardized against a primary grade standard.

SRM	Type	Unit Size (in g)	Certified Use	Stoichiometric Purity (mass fraction, in %)
17e	Sucrose			In Prep
40h	Sodium Oxalate	60	Reductometric Value	99.972
41c	Dextrose (D-Glucose)	70	Polarimetric Value	99.9
83d	Arsenic Trioxide	60	Reductometric Value	99.9926
84j	Potassium Hydrogen Phthalate	60	Acidimetric Value	99.996
136e	Potassium Dichromate	60	Oxidimetric Value	99.984
350a	Benzoic Acid	30	Acidimetric Value	99.9958
351	Sodium Carbonate	50	Acidimetric Value for:	
			Sodium Carbonate	99.9796
723c	Tris(hydroxymethyl)aminomethane			In Prep
951	Boric Acid	100	Acidimetric and Boron Isotopic Value	100.00
987	Strontium Carbonate	1	Assay and Isotopic Values	99.98
999a	Potassium Chloride	60	Assay Values for:	
			Potassium Chloride	99.9817
			Potassium	52.4354
			Chloride	47.5463

Values in parentheses are not certified and are given for information only.

104. Microchemistry (powder form)

SRM	Type	Unit Size (in g)	Composition (mass fraction, in %)							
			C	H	N	Br	Cl	F	S	CH_3O-
141d	Acetanilide	In Prep								
142	Anisic Acid	2								20.40
143d	Cystine	In Prep								
148	Nicotinic Acid	2	58.54	4.09	11.38					
2141	Urea	2			46.63					
2142	o-Bromobenzoic Acid	2				39.80				
2143	p-Fluorobenzoic Acid	2						13.54		
2144	m-Chlorobenzoic Acid	2					22.62			

104. Spectrometry, Single Element Standard Solutions

These SRMs are intended as standard solutions for use in calibrating instruments used in atomic spectrometry, including atomic absorption spectrometry, inductively coupled plasma optical spectrometry, and inductively coupled plasma mass spectrometry. They can also be used in conjunction with any other analytical technique or procedure where aqueous standard solutions are required. Each SRM is a single element solution of 50 mL with a nominal concentration of 10 mg/g, except where indicated. **NOTE:** The certified values for SRM standard solution lots produced after March 1997 are stated in mass units, **mg/g**, rather than *mg/mL*. For the convenience of the user, each certificate provides instructions for preparing SRM dilutions by volume as well as by mass.

SRM	Element	Nominal Acid Concentration
3101a	Aluminum	HNO_3 10%
3102a	Antimony	HNO_3 10% + HF 2%
3103a	Arsenic	HNO_3 15%
3104a	Barium	HNO_3 1%
3105a	Beryllium	HNO_3 10%
3106	Bismuth	HNO_3 10%
3107	Boron (5 mg/g)	H_2O
3108	Cadmium	HNO_3 10%
3109a	Calcium	HNO_3 10%
3110	Cerium	HNO_3 10%
3111a	Cesium	HNO_3 1%
3112a	Chromium	HNO_3 10%
3113	Cobalt	HNO_3 10%
3114	Copper	HNO_3 10%
3115a	Dysprosium	HNO_3 10%
3116a	Erbium	HNO_3 10%
3117a	Europium	HNO_3 16%
3118a	Gadolinium	HNO_3 10%
3119a	Gallium	HNO_3 10%
3120	Germanium	Oxalic Acid 10%
3121	Gold	HNO_3 5% + HF 2%
3122	Hafnium	HNO_3 10% + HF 2%
3123a	Holmium	HNO_3 16%
3124a	Indium	HNO_3 10%
3126a	Iron	HNO_3 10%
3127a	Lanthanum	HNO_3 10%
3128	Lead	HNO_3 10%
3129a	Lithium	HNO_3 1%
3130a	Lutetium	HNO_3 10%
3131a	Magnesium	HNO_3 10%
3132	Manganese	HNO_3 10%
3133	Mercury	HNO_3 10%
3134	Molybdenum	HCl 10%
3135a	Neodymium	HNO_3 10%
3136	Nickel	HNO_3 10%
3137	Niobium	5% HNO_3 + HF 2%
3138	Palladium	HCl 10%
3139a	Phosphorus	HNO_3 0.8%
3140	Platinum	HCl 10%
3141a	Potassium	HNO_3 1%
3142a	Praseodymium	HNO_3 10%
3143	Rhenium	HNO_3 10%
3144	Rhodium (1 mg/g)	HCl 10%
3145a	Rubidium	HNO_3 1%

104. Spectrometry, Single Element Standard Solutions – Continued

SRM	Element	Acid Concentration
3147a	Samarium	HNO_3 10%
3148a	Scandium	HNO_3 10%
3149	Selenium	HNO_3 10%
3150	Silicon	H_2O
3151	Silver	HNO_3 10%
3152a	Sodium	HNO_3 1%
3153a	Strontium	HNO_3 10%
3154	Sulfur	H_2SO_4 0.1%
3155	Tantalum	HNO_3 5% + HF 2%
3156	Tellurium	HCl 20%
3157a	Terbium	HNO_3 16%
3158	Thallium	HNO_3 10%
3159	Thorium	HNO_3 10%
3160a	Thulium	HNO_3 10%
3161a	Tin	HNO_3 5% + HF 2%
3162a	Titanium	HNO_3 10% + HF 2%
3163	Tungsten	HNO_3 7% + HF 4%
3164	Uranium	HNO_3 10%
3165	Vanadium (5 mg/g)	HNO_3 10%
3166a	Ytterbium	HNO_3 16%
3167a	Yttrium	HNO_3 10%
3168a	Zinc	HNO_3 10%
3169	Zirconium	HNO_3 10% + HF 2%

104. Spectrometry, Multielement Standard Solutions

SRMs 3171a and 3172a each consists of a single 50 mL solution containing several elements in concentration ratios appropriate for natural water and similar type sample analysis. SRM 3179 consists of a set of three 50 mL solutions, (3179-I, 3179-II and 3179-III), designed to be combined, diluted (I, 1:100; II and III, 1:1000), and used immediately, as the full combination of elements is unstable over extended periods of time. The elemental concentration ratios in the final combined and diluted solution of SRM 3179 are appropriate for the analysis of soil, sediment, and sludge leachates.

SRM 3171a Multielement Mix A1 Standard Solution (in HNO_3 5%)

Element	Nominal Concentration (in µg/g)
Aluminum	100
Antimony	100
Beryllium	10
Cadmium	100
Chromium	100
Iron	100
Magnesium	100
Manganese	100
Molybdenum	100
Nickel	100
Potassium	500
Sodium	100
Vanadium	100

104. Spectrometry, Multielement Standard Solutions – Continued

SRM 3172a Multielement Mix B1 Standard Solution (in HNO_3 5%)

Element	Nominal Concentration (in μg/g)
Arsenic	200
Barium	10
Calcium	10
Cobalt	100
Copper	100
Lead	100
Selenium	500
Silver	100
Strontium	10
Thallium	100
Zinc	100

SRM 3179 Multielement Mixes I, II, and III Standard Solutions (in HNO_3 5%)

	Element	Nominal Concentration (in μg/g)
I	Aluminum	100
	Arsenic	200
	Iron	200
	Lead	100
	Magnesium	100
	Manganese	100
	Phosphorus	100
	Potassium	100
	Sodium	100
	Vanadium	50
	Zinc	100
II	Barium	100
	Cadmium	100
	Calcium	100
	Chromium	100
	Cobalt	100
	Copper	100
	Lanthanum	100
	Lithium	100
	Molybdenum	100
	Nickel	100
	Strontium	100
III	Silver	100

104. Chromium Speciation (solution form)

These SRMs are intended for use in conjunction with the measurement of specific species of chromium, and consist of 50 mL solutions.

SRM	Source, Purity, %	Diluent	Element Concentration (in mg/mL)	
			Cr (III)	Cr (VI)
2108	Metal, (99.999+)	HCl, 1%	In Prep	<0.001
2109	SRM 136e (99.984)	deionized H_2O	<0.005	1.000±0.004

104. Anion Chromatography (solution form)

These SRMs are single component solutions prepared gravimetrically for use in anion chromatography or any other technique that requires aqueous standard solutions for calibration of control materials.

SRM	Anion	Unit Size (in mL)	Nominal Concentration (in mg/kg)
3181	Sulfate	50	1000
3182	Chloride	50	1000
3183	Fluoride	50	1000
3184	Bromide	50	1000
3185	Nitrate	50	1000
3186	Phosphate	50	1000

104. Stable Isotopic Materials (solid and solution forms)

The isotopic composition of these SRMs has been determined by mass spectrometry.

SRM	Type	Element/Isotopic Composition Certified	Unit Size (in g)
951	Boric Acid, assay and isotopic	Boron	100 powder
952	Boric Acid, 95% enriched ^{10}B, assay and isotopic	Boron	0.25 powder
975a	Sodium Chloride	Chlorine	In Prep
976	Copper Metal	Copper	0.4 disk
977	Sodium Bromide	Bromine	0.25 powder
978a	Silver Nitrate	Silver	0.25 powder
979	Chromium Nitrate	Chromium	0.25 powder
980	Magnesium Metal	Magnesium	0.25 chips
981	Lead Metal, natural	Lead	1.0 wire
*982	Lead Metal, equal atom ($^{208}Pb/^{206}Pb$)	Lead	1.0 wire
*983	Lead Metal, radiogenic (92% ^{206}Pb)	Lead	1.0 wire
984	Rubidium Chloride, assay and isotopic	Rubidium	0.25 powder
985	Potassium Chloride, assay and isotopic	Potassium	1.0 powder
986	Nickel Metal	Nickel	0.5 powder
987	Strontium Carbonate, assay and isotopic	Strontium	1.0 powder
989	Rhenium Metal, assay and isotopic	Rhenium	0.003 cm×0.0076 cm×1.90 cm ribbon
990	Silicon Metal, assay and isotopic	Silicon	3 cm×0.2 cm wafer
991	Lead–206 Nitrate Spike, assay and isotopic	Lead	15 solution
994	Gallium Metal, isotopic	Gallium	0.25 disk
997	Thallium Metal, isotopic	Thallium	0.25 rod

*These SRMs are radioactive, containing Lead-210 of natural origin. All users and purchasers must comply with all national and international regulations regarding the use and disposal of these SRMs.

104. Light Stable Isotopic Materials (gas, liquid and solid forms)

These RMs are for calibration of isotope-ratio mass spectrometers and associated sample preparation systems. They are distributed by NIST on behalf of the International Atomic Energy Agency (IAEA). At the request of the IAEA, quantities of these materials are limited to *one unit of each RM per laboratory every 3 years*.

The isotopic compositions are given in parts per thousand difference from isotope-ratio standards—Vienna Standard Mean Ocean Water (VSMOW), Vienna PeeDee Belemnite (VPDB), atmospheric N_2 (Air), NBS28 Silica Sand (optical), and Canyon Diablo Troilite (CDT). The exception is Lithium (Li), which is expressed as an absolute isotopic ratio.

RM	Type (IAEA Designation)	Nominal Unit Size	Nominal Isotopic Composition (in parts per 1000)						
			δD_{VSMOW}	$^6Li/^7Li$	$\delta^{13}C_{VPDB}$	$\delta^{15}N_{Air}$	$\delta^{18}O_{VSMOW}$	$\delta^{30}Si_{NBS28}$	$\delta^{34}S_{CDT}$
8535	VSMOW–water	20 mL	0*				0 *		
8536	GISP–water	20 mL	−190				−24.8		
8537	SLAP–water	20 mL	−428*				−55.5*		
8538	NBS30–biotite	2 g	−66				+5.1		
8539	NBS22–oil	1 mL	−120		−29.7				
8540	PEFI–polyethylene foil	x mg	−100		−31.8				
8541	USGS24–graphite	0.8 g			−16				
8542	Sucrose ANU–sucrose	1 g			−10.5				
8543	NBS18–carbonatite	0.4 g			−5.0		+7.2		
8544	NBS19–limestone	0.4 g			+1.95*		+28.6		
8545	LSVEC–lithium carbonate	0.4 g		0.0814†	−47		+3		
8546	NBS28–silica sand (optical)	0.4 g					+9.6	0*	
8547	IAEA-N1–ammonium sulfate	0.4 g				+0.4			
8548	IAEA-N2–ammonium sulfate	0.4 g				+20.3			
8549	IAEA-N3–potassium nitrate	0.4 g				+2			
8550	USGS25–ammonium sulfate	0.5 g				−30.4			
8551	USGS26–ammonium sulfate	0.5 g				+53.5			
8552	NSVEC–gaseous nitrogen	300 μmol				−2.8			
8553	Soufre de Lacq–elemental sulfur	0.5 g							+16
8554	IAEA-S1–silver sulfide	0.5 g							−0.3
8555	IAEA-S2–silver sulfide	0.5 g							+21
8556	NBS123–sphalerite	0.5 g							+17
8557	NBS127–barium sulfate	0.5 g					+9.3		+20
8558	USGS32—potassium nitrate	0.5 g				+179.9			

*Exactly defined isotopic abundances
†Absolute isotopic ratio

105. Health and Industrial Hygiene

Clinical Laboratory Materials (gas, liquid, and solid forms)

The following SRMs are for calibrating apparatus and validating analytical methods used in clinical and pathology laboratories. Additional information on the serum materials is given in the table on the following page.

SRM	Type	Purity/Constituent (mass fraction, in %)	Unit Size
900	Antiepilepsy Drug Level Assay (phenytoin, ethosuximide, phenobarbital, and primidone)		Set of 4 ampules
909b	Human Serum		Set of 6 bottles
910	Sodium Pyruvate	98.7	25 g
911b	Cholesterol	99.8	2 g
912a	Urea	99.9	25 g
913	Uric Acid	99.7	10 g
914a	Creatinine	99.7	10 g
915a	Calcium Carbonate	99.9	20 g
916a	Bilirubin	98.3	100 mg
917a	D-Glucose (Dextrose)	99.7	25 g
918a	Potassium Chloride	99.9817	30 g
919a	Sodium Chloride	99.89	30 g
920	D-Mannitol	99.8	50 g
921	Cortisol (Hydrocortisone)	98.9	1 g
*924a	Lithium Carbonate	99.9	30 g
925	VMA (4–hydroxy–3–methoxymandelic acid)	99.4	1 g
927c	Bovine Serum Albumin		In Prep
928	Lead Nitrate	100.00	30 g
929	Magnesium Gluconate Dihydrate	**Mg 5.403**	5 g
937	Iron Metal (Clinical)	99.90	50 g
938	4–Nitrophenol	(99.75)	15 g
955b	Lead in Blood		Set of 4 ampules
*956a	Electrolytes in Frozen Human Serum		Set of 6 ampules
965	Glucose in Frozen Human Serum		Set of 4 ampules
966	Toxic Elements in Blood		In Prep
968b	Fat-Soluble Vitamins and Cholesterol in Human Serum		Set of 3 ampules
998	Angiotensin I (Human)	94.1	0.5 mg
1400	Bone Ash	8 elements	50 g
1486	Bone Meal	8 elements	50 g
1595	Tripalmitin	99.5	2 g
1598	Inorganic Constituents in Bovine Serum		Set of 2 ampules
1599	Anticonvulsant Drug Level Assay (valproic acid and carbamazepine)		Set of 4 ampules
1951a	Lipids in Frozen Human Serum		Set of 6 bottles
1952a	Cholesterol in Human Serum (Freeze-dried)		Set of 6 bottles
2389	Amino Acids in HCl	17 amino acids	Set of 5 ampules

Values in parentheses are not certified and are given for information only.
*Conforms to National Committee for Clinical Laboratory Standards (NCCLS) specification ACC–1.

105. Serum Materials (frozen, liquid, and lyophilized forms)

These SRMs serve a variety of clinical measurement needs. SRM 909b is a lyophilized human serum for use in determining specified constituents. SRM 927b is a bovine serum albumin in a sterile 7% solution for use in the calibration and standardization of procedures to analyze total serum protein. SRM 956a is a frozen human serum for use in the calibration and standardization of procedures for the determination of specific electrolytes in either diluted or undiluted human serum or plasma. SRM 965 is a frozen human serum for evaluating the accuracy of procedures used to determine glucose in human serum and to validate secondary reference materials. SRM 968b is a lyophilized human serum for validating methods used to determine fat-soluble vitamins, carotenoids, and cholesterol in human serum and plasma. SRM 1951 is a frozen human serum for evaluating the accuracy of clinical procedures for the determination of total cholesterol, HDL-cholesterol, LDL-cholesterol and triglycerides (triglyerides and total glyceride species).

SRM	Type	Unit Size	Analyte Concentrations (in mmol/L)		
				909b-1	909b-2
909b	Human Serum	909b-1; 3 bottles 909b-2; 3 bottles	Calcium	2.218	3.532
			Chloride	89.11	119.43
			Cholesterol	3.787	6.084
			Creatinine	0.05681	0.4674
			Lithium	0.6145	2.600
			Magnesium	0.7634	1.918
			Potassium	3.424	6.278
			Sodium	120.76	141.0
			Total Glycerides	0.949	1.529
			Glycerides	0.804	1.271
			Urea	5.51	30.75
			Uric Acid	2.809	0.7579
927c	Bovine Serum Albumin			In Prep	
				Level I	Level II	Level III
956a	Electrolytes in Frozen Human Serum	Level I; 2 ampules Level II; 2 ampules Level III; 2 ampules	Calcium	3.025	2.570	2.127
			Lithium	2.083	1.34	0.570
			Magnesium	1.441	0.947	0.448
			Potassium	6.008	3.985	2.025
			Sodium	121.4	141.0	160.9
				Level I	Level II	Level III
965	Glucose in Frozen Human Serum	Level I; 2 ampules Level II; 2 ampules Level III; 2 ampules	Glucose	5.680	11.097	16.355
				Low*	Middle*	High*
968b	Human Serum	Low; 1 vial Middle; 1 vial High; 1 vial	Retinol	1.033	1.794	3.11
			Retinyl Palmitate	0.189	0.339	0.469
			α-Tocopherol	16.4	23.5	41.4
			trans-β-Carotene	0.417	1.06	2.10
			Total-β-Carotene	0.471	1.17	2.31
			Total α-Carotene	0.0410	0.070	0.099
			Lutein	0.108	0.111	0.0687
			Cholesterol	2240	3735	3300
				Level I	Level II	
1951a	Lipids in Frozen Human Serum	Level I; 2 bottles Level II; 2 bottles	Cholesterol	4.7109	7.1554	
			Total Glycerides	1.1357	1.9477	
			Triglyerides Only	1.0053	1.7462	

*Analyte Concentrations are expressed in μmol/L.

105. Ethanol Solutions

This SRM is for use in the calibration of instruments and techniques for the determination of ethanol (ethyl alcohol) in breath and blood. SRM 1828a consists of four concentrations of ethanol-water solutions in a set of five ampules.

SRM	Type	Certified Constituent (mass fraction, in %)	Unit Size
1828a	Ethanol in Water Solutions	Ethanol: 95.60	Set: 1, 20 mL ampules
		Ethanol: 2.003	2, 20 mL ampules
		Ethanol: 0.0960	1, 5 mL ampules
		Ethanol: 0.02309	1, 5 mL ampules

105. Toxic Substances in Urine (powder form)

SRMs 2670, 2671a and 2672a are for determining toxic substances in human urine. They consist of freeze-dried urine and are provided in sets of four 30 mL bottles—two each at low and elevated levels. **NOTE:** The values listed for these SRMs apply only to reconstituted urine.

SRM	Type	Low/Elevated Elemental Composition (in mg/L)				
		Al	As	Be	Cd	Ca
2670	Toxic Metals	(0.18)/(0.18)	(0.06)/0.48	(≤0.0005)/(0.033)	(0.00040)/0.088	0.105/0.105 g/L
2671a	Fluoride					
2672a	Mercury					

SRM	Cl	Cr	Cu	F	Au	Pb	Mg	Mn
2670	(4.4)/(4.4) g/L	(0.013)/0.085	0.13/0.37		(0.008)*/(0.24)	(0.01)/0.109	0.063/0.063 g/L	(0.03)/(0.33)
2671a				0.55/5.7				
2672a								

SRM	Hg	Ni	Pt	K	Se	Na	V	SO_4
2670	(0.002)/0.105	(0.07)/(0.30)	(0.008)*/(0.12)	(1.5)/(1.5) g/L	0.030/0.46	2.62/2.62 g/L	−/(0.12)	(1.3)/(1.3) g/L
2671a								
2672a	(0.002)/0.105							

Values in parentheses are not certified and are given for information only.
*Value is in μg/L.

105. Drugs of Abuse in Urine, Single Analyte (powder form)

These SRMs are for verifying the accuracy of methods used to determine marijuana, benzoylecgonine (cocaine metabolite), morphine glucuronide, and cotinine substances classed as drugs of abuse in humans or metabolites of drugs of abuse. SRMs 1507b, 1508a, and 2382 consist of freeze-dried urine and are provided in sets of four 20 mL bottles—three levels plus a blank. RM 8444 consists of freeze-dried urine in a set of four 5 mL vials—two levels and two blanks. Each SRM/RM consists of a single analyte drug of abuse.

SRM/RM	Type	Unit Size	Component (in μg/L)			
			I Blank	II Low	III Medium	IV High
1507b	THC–9–COOH	Set of 4 bottles	x_D:<1	11.7	24.1	49.6
1508a	Benzoylecgonine	Set of 4 bottles	In Prep			
2382	Morphine Glucuronide	Set of 4 bottles	x_D:<1	209	437	853
8444	Cotinine	Set of 4 vials	0.8	54		488

105. Drugs of Abuse in Urine, Multianalyte (powder form)

These SRMs are for verifying the accuracy of methods used to determine cocaine, morphine and codeine and opiate-based substances classed as drugs of abuse in humans. Each SRM consists of multianalyte drugs of abuse. SRM 1511 consists of a mixture of five substances—morphine, codeine, cocaine metabolite, marijuana metabolite and phencyclidine in freeze-dried urine and is provided as a set of three bottles, each containing all analytes (no blank). SRM 2381 consists of freeze-dried urine and is provided in a set of four 20 mL bottles—three levels plus a blank.

SRM	Type	Unit Size	Component (in µg/L)				
			Benzoyl-ecgonine	Morphine	Codeine	THC–9–COOH	Phen-cyclidine
1511	Multi-Drugs of Abuse	Set of 3 bottles	162	309	288	14.1	23.8
2381	Morphine and Codeine	Set of 4 bottles		134–580	130–560		

105. Drugs of Abuse in Hair (solid forms)

These SRMs were developed primarily to further research related to the accurate determination of drugs of abuse in human hair. The values provided on the Reports of Investigation are not certified. Rather they are "Best Estimates" based on proven NIST methods.

RM	Type	Unit Size (in mg)	Component (in mg/kg)			
			Cocaine	Benzoylecgonine	Morphine	Codeine
8448	Human Hair Segments	110–125	7.3	1.6	11.9	6.7
8449	Powdered Human Hair	100–120	7.0	4.0	4.3	2.9

105. DNA Profiling (solid forms)

These SRMs are intended for use in the standardization of forensic and paternity quality assurance procedures and instructional law enforcement or non-clinical research purposes. SRM 2390 DNA Profiling Standard, based on Restriction Fragment Length Polymorphism (RFLP) testing, is certified for the sizes of each allelic band of five commonly used DNA probes of two human DNA samples; one is from a female cell line, and the other is from a male source. SRM 2391 [Polymerase Chain Reaction] PCR-Based DNA Profiling Standard is certified for allele assignment of D1S80 loci for eight human DNA samples plus two human cell lines. Both SRMs consist of 20 components. SRM 2392 DNA Standard for Mitochrondrial Sequencing is currently under development.

SRM	Type	Unit of Issue
2390	DNA Profiling	20 components: boxes A, B, and C
2391	PCR-Based DNA Profiling	20 components: boxes A and B

105. Biomaterials (solid forms)

This SRM is intended for use in evaluating the physical and chemical properties of calcium apatites of biological, geological, and synthetic origins, that are used in the manufacture of medical implants made from biomaterials (materials used for medical purposes). SRM 2910 is certified for calcium and phosphorus contents, Ca/P molar ratio, specific surface area, and solubility product. Reference values are supplied for hydrogen phosphate, carbonate and water contents in addition to physical properties determined from x-ray powder diffraction data.

SRM	Type	Unit Size (in g)
2910	Calcium Hydroxyapatite	5

105. Materials on Filter Media

These SRMs consist of potentially hazardous materials deposited on filters to be used to determine the levels of these materials in industrial atmospheres. SRMs 2676d, 2677a, and 2679a provide element values at four different levels; SRM 3087a provides element values at one level only. SRMs 2676d, 2677a, and 3087a are each 37 mm diameter and 0.8 μm pore size; SRM 2679a is 47 mm diameter and 0.45 μm pore size.

SRM	Type	Unit Size	Element/Component (in μg/filter)				
				I	II	III	IV
2676d	Metals on Filter Media	Set of 8	Cadmium	0.97	2.81	10.04	(<0.0005)
			Lead	7.44	14.82	29.77	(<0.0005)
			Manganese	2.09	9.83	19.83	(<0.0005)
			Zinc	10.17	49.47	99.31	(0.26)
2677a	Beryllium and Arsenic on Filter Media	2 Sets of 5	Beryllium	0.129	0.643	2.58	0.050 ≤0.0005 Blank
			Arsenic	0.269	2.69	26.92	0.101 ≤0.0005 Blank
2679a	Quartz on Filter Media	Set of 4	Quartz	≤2	30.8	80.2	202.7
			Clay	(370)	(370)	(370)	(370)
3087a	Metals on Filter Media	Set of 6 and 6 blanks	Arsenic	50.48			
			Barium	25.24			
			Cadmium	15.14			
			Chromium	10.10			
			Iron	25.24			
			Magnesium	25.24			
			Manganese	10.10			
			Nickel	25.24			
			Lead	40.38			
			Selenium	25.24			
			Vanadium	50.48			
			Zinc	100.94			

Values in parentheses are not certified and are given for information only.

105. Trace Constituent Elements in Blank Filters

SRMs 2678 and 2681 are for use in evaluating the performance of air sampling filter methods with two different filter types or sizes commonly used in air sampling of industrial atmospheres. For both SRMs, either certified values (in μg), or limits of detection (X_D), for each of 30 constituent elements as well as six leachable anions and cations are provided.

SRM	Type	Diameter (in mm)	Pore Size (in μm)	Filter Weight (in g)
2678	Cellulose Acetate Membrane	47	0.45	0.09
2681	Ashless	42.5		0.14

105. Respirable Silica (powder form)

SRMs 1878a and 1879a are crystalline silica materials with particles in the respirable range. They are intended for use in determining by x-ray diffraction, the levels of respirable silica in an industrial atmosphere according to NIOSH Analytical Method P&CAM 259 or equivalent methods. **NOTE:** These SRMs are not certified for particle size.

SRM	Type	Unit Size	Component (mass fraction, in %)
1878a	Respirable Alpha Quartz	5 g	In Prep
1879a	Respirable Cristobalite	5 g	In Prep

105. Lead in Paint, Dust, and Soil (powder and sheet forms)

These SRMs and RM have been developed in conjunction with the U.S. EPA to monitor paint, soil, and dust sources of lead. SRMs 2570 through 2576 consist of one Mylar™ sheet per unit. Each sheet, 7.6 cm × 10.2 cm, is coated with a single uniform paint layer for use with portable x-ray fluorescence analyzers. SRM 2579a consists of a set of six Mylar™ sheets, one each of SRMs 2570 through 2575. SRMs 2580, 2581, 2582, and 2589 consist of paint that has been ground and homogenized into a powder, 99+ % of which passes a 100 μm sieve. SRM 2583 consists of dust, 99+ % of which passes a 100 μm sieve, that was collected in vacuum cleaner bags during routine cleaning of dwelling interiors. SRM 2583 is certified for arsenic, chromium, cadmium, lead, and mercury. [Also see Category 106.] SRMs 2584, 2586, and 2587 are dust or soil matrices containing lead from paint. RM 8680 consists of a 10.2 cm wide × 15.2 cm long × 1.3 cm thick section of painted fiberboard and is intended for use in the evaluation of destructive and nondestructive methods of measuring lead in paint on fiberboard.

SRM	Type	Unit Size	Lead Concentration
2570	Lead Paint Film, Blank	1 sheet	In Prep
2571	Lead Paint Film, Nominal 3.5 mg/cm^2	1 sheet	In Prep
2572	Lead Paint Film, Nominal 1.6 mg/cm^2	1 sheet	In Prep
2573	Lead Paint Film, Nominal 1.0 mg/cm^2	1 sheet	In Prep
2574	Lead Paint Film, Nominal 0.7 mg/cm^2	1 sheet	In Prep
2575	Lead Paint Film, Nominal 0.3 mg/cm^2	1 sheet	In Prep
2576	Lead Paint Film, High Level	1 sheet	In Prep
2579a	Lead Paint Films for Portable X-ray Fluorescence Analyzers (SRMs 2570-2575)	6 sheets	3.5 to <0.0001 mg/cm^2
2580	Powdered Paint, Nominal 4 % Lead	30 g	4.34 %
2581	Powdered Paint, Nominal 0.5 % Lead	35 g	0.449 %
2582	Powdered Paint, Nominal 200 mg/kg Lead	20 g	209.8 mg/kg
2583	Trace Elements in Indoor Dust	8 g	85.9 mg/kg
2584	Trace Elements in Indoor Dust, Nominal 1 % Lead	In Prep	
2586	Trace Elements in Soil Containing Lead from Paint, Nominal 500 mg/kg Lead	In Prep	
2587	Trace Elements in Soil Containing Lead from Paint, Nominal 3000 mg/kg Lead	In Prep	
2589	Powdered Paint, Nominal 10 % Lead	35 g	9.99 %
RM 8680	Paint on Fiberboard, Nominal 1 to 2 mg/cm^2	1 sheet	individually value assigned

105. Asbestos

These SRMs are for use in identifying and quantifying asbestos types. SRM 1866a consists of a set of three common bulk mine-grade asbestos materials; chrysotile, grunerite (Amosite), riebeckite (Crocidolite), and one glass fiber sample. SRM 1867 consists of a set of three uncommon mine-grade asbestos materials; antophyllite, tremolite, and actinolite. The optical properties of SRMs 1866a and 1867 as observed by polarized light microscopy (PLM), have been characterized so that they may serve as primary calibration standards for the identification of asbestos types in building materials.

SRM 1868 consists of a set of two common bulk mine-grade asbestos materials; chrysotile and grunerite (Amosite), contained in matrices simulating building materials (calcium carbonate and glass fiber), in quantities at just below the U.S. EPA regulatory limit of 1%. This SRM is certified by weight for the quantity of each asbestos material present.

SRM 1876b is intended for use in evaluating the techniques used to identify and count chrysotile asbestos fibers by transmission electron microscopy (TEM). A unit consists of sections of mixed-cellulose-ester filters containing chrysotile asbestos fibers deposited by an aerosol generator.

RM 8411 consists of a section of collapsed mixed-cellulose-ester filters with a high concentration (138 fibers/0.01 mm^2) of chrysotile asbestos and a medium concentration (43 fibers/0.01 mm^2) of grunerite (Amosite) asbestos. It is intended for use in evaluating the techniques used to identify and count asbestos fibers by transmission electron microscopy (TEM).

SRM	Type	Unit Size
1866a	Common Commercial Asbestos	Set of 3: 4 g each
1867	Uncommon Commercial Asbestos	Set of 3: 5 to 10 g each
1868	Quantitative Asbestos in Building Materials	Set of 2: 5 to 10 g each
1876b	Chrysotile Asbestos for TEM	Set of 10: 3 mm × 3 mm
8411	Mixed Asbestos Research Filter	1 cm^2

106. Inorganics

106. Metal Constituents in Natural Matrices (liquid and solid forms)

These SRMs and RM are for analysis of materials of health or environmental interest. [Also see Categories 105 and 111.]

SRM	Type	Unit Size	Elemental Composition
1640	Natural Water	250 mL	17 elements certified
1641c	Mercury in Water	6×20 mL	Hg: 1.47 mg/L
1643d	Trace Elements in Water	250 mL	26 elements certified
1646a	Estuarine Sediment	75 g	20 elements certified
1648	Urban Particulate Matter	2 g	14 elements certified
2583	Trace Elements in Indoor Dust	8 g	5 elements certified
2694b	Simulated Rainwater		In Prep
2704a	Buffalo River Sediment	50 g	In Prep
2709	San Joaquin Soil	50 g	26 elements certified
2710	Montana Soil Highly Elevated Trace Element Concentrations	50 g	21 elements certified
2711	Montana Soil Moderately Elevated Trace Element Concentrations	50 g	24 elements certified
2781	Domestic Sludge	40 g	10 elements certified
2782	Industrial Sludge		In Prep
RM 8407	Tennessee River Sediment	25 g	Hg: 0.50 mg/kg

106. Simulated Rainwaters (liquid form)

This SRM was developed to aid in the analysis of acidic rainwater by providing a stable, homogeneous material at two levels of acidity.

SRM	Type	Unit Size
2694b	Simulated Rainwater	Set of 4: 2 × 50 mL at each of 2 levels

Constituent Element/Parameter	2694b–I	2694b–II
pH, 25 °C	In Prep	In Prep
Electrolytic Conductivity (μS/cm, 25 °C)		
Acidity, meq/L		
Fluoride, mg/L		
Chloride, mg/L		
Nitrate, mg/L		
Sulfate, mg/L		
Sodium, mg/L		
Potassium, mg/L		
Ammonium, mg/L		
Calcium, mg/L		
Magnesium, mg/L		

Values in parentheses are not certified and are given for information only.

106. Thin Films for X-Ray Fluorescence

This SRM is for standardizing x-ray spectrometers. It may be useful in elemental analysis of particulate matter collected on filter media, and where x-ray spectrometer calibration functions are determined using thin film standards. Each SRM unit is individually certified and consists of a silica base glass film (0.5 μm thick) deposited on a 47 mm diameter polycarbonate filter mounted on an aluminum ring.

SRM	Type	Elemental Composition per area (in μg/cm²)					
		Fe	Pb	K	Si	Ti	Zn
1833	Thin Glass Film	— Out of Stock —					

106. Carbon Modified Silica (powder form)

This SRM is intended for the calibration of instruments used to measure total elemental carbon. The SRM consists of three, 1-g bottles of chemically modified microparticulate silica.

SRM	Type	Bottle	Carbon (mass fraction, in %)
1216	Carbon Modified Silica	I	0.70
		II	9.06
		III	17.04

106. Trace Elements (solid form)

This SRM is for analysis of trace elements in materials of environmental interest.

SRM	Type	Unit Size	Trace Elements (in mg/kg unless noted as mass fraction, in %)			
			Al	Sb	As	Ba
1648	Urban Particulate Matter	2 g	3.42 %	(45)	115	(737)

SRM	Br	Cd	Ce	Cs	Cl	Cr	Co	Cu
1648	(500)	75	(55)	(3)	(0.45 %)	403	(18)	609

SRM	Hf	In	I	Fe	La	Pb	Mg	Mn	Ni
1648	(4.4)	(1.0)	(20)	3.91 %	(42)	0.655 %	(0.8 %)	786	82

SRM	K	Rb	Sc	Se	Ag	S	Na	Th	Ti	U	V	W	Zn
1648	1.05 %	(52)	(7)	27	(6)	(5.0)	0.425 %	(7.4)	(0.40 %)	5.5	127	(4.8)	0.476 %

Values in parentheses are not certified and are given for information only.

106. Used Auto Catalysts (powder form)

These SRMs are intended for use in the evaluation of methods for the analysis of the platinum group metals and lead in auto catalysts. They were produced in cooperation with the International Precious Metals Institute and are issued as fine (<74 μm) powders.

SRM	Type	Unit Size	Elemental Composition (in mg/kg)			
			Pt	Pd	Rh	Pb
2556	Recycled Pellet	70 g	697.4	326.0	51.2	6228
2557	Recycled Monolith	70 g	1131	233.2	135.1	13931

107. Primary Gas Mixtures

These SRMs are for calibrating equipment and apparatus used to measure various components of gas mixtures and atmospheric pollutants. The typical gas mixture is supplied in a DOT 3AL specification aluminum (6061 alloy) cylinder with a nominal pressure exceeding 12.4 mPa that provides the user with approximately 0.73 m^3 of usable mixture. Due to increasing customer demand, these primary gas mixtures are in short supply and may not be readily available for sale. In such cases, a NIST traceable reference gas described below may be substituted.

A NIST Traceable Reference Material (NTRM) is a reference material produced by a commercial supplier with a well-defined ***traceability*** to NIST. This traceability is established via criteria and protocols defined by NIST that are tailored to meet the needs of the metrological community to be served. The NTRM concept was established to allow NIST to respond to the increasing needs for high quality reference materials by leveraging its relatively fixed human and financial resources with secondary reference material producers. Reference material producers adhering to NIST defined protocol requirements are allowed to use the "NTRM" trademark to identify their product.

The gas NTRM program was established in 1992 in partnership with the U.S. EPA and specialty gas companies as a means for providing end-users with the wide variety of certified gas standards needed to implement the "Emissions Trading" provision of the 1990 Clean Air Act. Gas NTRMs are produced and distributed by specialty gas companies with NIST oversight of the production and maintenance, and direct involvement in the analysis. NTRMs can be developed for any pollutant, concentration, and balance gas combination for which a NIST primary standard or SRM exists. The gas standards prepared according to this program are related, within known limits of ***uncertainty***, to specific gaseous primary standards maintained by NIST.

Those SRMs that are marked "†" are available as NTRMs from commercial suppliers. A supplier list can be obtained upon request from the SRM Program Sales Office.

SRM	Type	Certified Component	Nominal Amount-of-substance fraction (in μmol/mol)
1674b†	Carbon Dioxide in Nitrogen	CO_2	7 mol %
1675b†	Carbon Dioxide in Nitrogen	CO_2	14 mol %
2619a	Carbon Dioxide in Nitrogen	CO_2	0.5 mol %
2620a	Carbon Dioxide in Nitrogen	CO_2	1.0 mol %
2621a	Carbon Dioxide in Nitrogen	CO_2	1.5 mol %
2622a	Carbon Dioxide in Nitrogen	CO_2	2.0 mol %
2623a	Carbon Dioxide in Nitrogen	CO_2	2.5 mol %
2624a	Carbon Dioxide in Nitrogen	CO_2	3.0 mol %
2625a†	Carbon Dioxide in Nitrogen	CO_2	3.5 mol %
2626a	Carbon Dioxide in Nitrogen	CO_2	4.0 mol %
2745†	Carbon Dioxide in Nitrogen	CO_2	16 mol %
2612a	Carbon Monoxide in Air	CO	10
2613a	Carbon Monoxide in Air	CO	20
2614a	Carbon Monoxide in Air	CO	45
1677c†	Carbon Monoxide in Nitrogen	CO	10
1678c†	Carbon Monoxide in Nitrogen	CO	50
1679c†	Carbon Monoxide in Nitrogen	CO	100
1680b†	Carbon Monoxide in Nitrogen	CO	500
1681b†	Carbon Monoxide in Nitrogen	CO	1000
2635a†	Carbon Monoxide in Nitrogen	CO	25
2636a†	Carbon Monoxide in Nitrogen	CO	250
2637a†	Carbon Monoxide in Nitrogen	CO	2500
2638a†	Carbon Monoxide in Nitrogen	CO	5000
2639a	Carbon Monoxide in Nitrogen	CO	1 mol %
2640a	Carbon Monoxide in Nitrogen	CO	2 mol %
2641a	Carbon Monoxide in Nitrogen	CO	4 mol %
2642a†	Carbon Monoxide in Nitrogen	CO	8 mol %
2740	Carbon Monoxide in Nitrogen	CO	10 mol %
2741	Carbon Monoxide in Nitrogen	CO	13 mol %

107. Primary Gas Mixtures – Continued

SRM	Type	Certified Component	Nominal Amount-of-Substance Fraction (in μmol/mol)
1658a	Methane in Air	CH_4	1
1659a	Methane in Air	CH_4	10
1660a	Methane-Propane in Air	CH_4	4
		C_3H_8	1
2750	Methane in Air	CH_4	50
2751	Methane in Air	CH_4	100
1683b†	Nitric Oxide in Nitrogen	NO	50
1684b†	Nitric Oxide in Nitrogen	NO	100
1685b†	Nitric Oxide in Nitrogen	NO	250
1686b†	Nitric Oxide in Nitrogen	NO	500
1687b†	Nitric Oxide in Nitrogen	NO	1000
2627a	Nitric Oxide in Nitrogen	NO	5
2628a	Nitric Oxide in Nitrogen	NO	10
2629a†	Nitric Oxide in Nitrogen	NO	20
2630†	Nitric Oxide in Nitrogen	NO	1500
2631a†	Nitric Oxide in Nitrogen	NO	3000
2735	Nitric Oxide in Nitrogen	NO	800
2736	Nitric Oxide in Nitrogen	NO	2000
2656	Oxides of Nitrogen in Air	NO_x	2500
2660†	Oxides of Nitrogen in Air	NO_x	100
2657a†	Oxygen in Nitrogen	O_2	2 mol %
2658a†	Oxygen in Nitrogen	O_2	10 mol %
2659a†	Oxygen in Nitrogen	O_2	21 mol %
1665b	Propane in Air	C_3H_8	3
1666b	Propane in Air	C_3H_8	10
1667b	Propane in Air	C_3H_8	50
1668b†	Propane in Air	C_3H_8	100
1669b	Propane in Air	C_3H_8	500
2764	Propane in Air	C_3H_8	0.25
1671a	Carbon Dioxide in Air	CO_2	340
1672a	Carbon Dioxide in Air	CO_2	350
2643a	Propane in Nitrogen	C_3H_8	100
2644a	Propane in Nitrogen	C_3H_8	250
2645a	Propane in Nitrogen	C_3H_8	500
2646a	Propane in Nitrogen	C_3H_8	1000
2647a	Propane in Nitrogen	C_3H_8	2500
2648a	Propane in Nitrogen	C_3H_8	5000
2649a	Propane in Nitrogen	C_3H_8	1 mol %
2650	Propane in Nitrogen	C_3H_8	2 mol %
1661a†	Sulfur Dioxide in Nitrogen	SO_2	500
1662a†	Sulfur Dioxide in Nitrogen	SO_2	1000
1663a†	Sulfur Dioxide in Nitrogen	SO_2	1500
1664a†	Sulfur Dioxide in Nitrogen	SO_2	2500
1693a†	Sulfur Dioxide in Nitrogen	SO_2	50
1694a†	Sulfur Dioxide in Nitrogen	SO_2	100
1696a†	Sulfur Dioxide in Nitrogen	SO_2	3500
1800	Ambient Non-Methane Organics in Nitrogen	(Fifteen components in large cylinder)	5 nmol/mol
1800a	Ambient Non-Methane Organics in Nitrogen	(Fifteen components in small cylinder)	5 nmol/mol
1804a	Ambient Toxic Organics in Nitrogen	(Nineteen components)	5 nmol/mol
2730	Hydrogen Sulfide in Nitrogen	H_2S	5
2731	Hydrogen Sulfide in Nitrogen	H_2S	20

107. Permeation Devices

These SRMs are primarily intended for use in calibrating air pollution monitoring apparatus and for calibrating air pollution analytical methods and procedures. Each tube is individually calibrated and certified according to NIST procedures and protocols.

SRM	Type	Tube Length (in cm)	Permeation Rate at 30 °C (in μg/min)	Amount-of-Substance Fraction (in μmol/mol) at Dilution Air Flow Rates of (L/min) @ 25 °C)		
				1	5	10
1625	Sulfur Dioxide Permeation Tube	10	2.8	1.1	0.21	0.11
1626	Sulfur Dioxide Permeation Tube	5	1.4	0.54	0.11	0.054

108. Fossil Fuels

Alcohols and Ethers [Oxygenates] in Reference Fuels (liquid form)

SRMs 1829, 1837, 1838, and 1839 are for calibrating instruments and validating methods used to determine various alcohols in gasoline. SRM 1829 is issued as a set of six sealed 20 mL ampules; SRMs 1837, 1838 and 1839 are each issued as a set of five sealed 20 mL ampules.

SRMs 2286 through 2297 were produced in response to the U.S. EPA Final Rule on Reformulated Gasoline aimed at reducing the volatile organic compounds emitted from gasoline. They consist of varying quantities of alcohol and ether (oxygenate) solutions in gasoline. SRMs 2286 through 2293 will be certified for constituent oxygenate concentration and resultant oxygen concentration in gasoline. Each SRM unit is issued as a set of three sealed 20 mL ampules—two ampules contain oxygenate and one ampule contains base reference gasoline. SRMs 2294 through 2297 will be certified for total olefins, total aromatics, oxygenate, sulfur, and benzene. Each SRM unit is issued as a set of two sealed 20 mL ampules. **[NOTE:** See Section 203 for Flash Point RMs.]

SRM	Type	Concentration (mass fraction, in %)				
		Methanol	Ethanol	Methanol and t-Butanol	Oxygenate	Oxygen
1829	Alcohols in Reference Fuels	0.335	11.39	10.33 + 6.63		
1837	Methanol and t-Butanol			10.33 + 6.63		
1838	Ethanol		11.39			
1839	Methanol	0.335				
2286	Ethanol in Gasoline				5.73	2.02
2287	Ethanol in Gasoline				10.07	3.53
2288	t-Amyl Methyl Ether in Gasoline				12.78	2.02
2289	t-Amyl Methyl Ether in Gasoline				17.30	2.73
2290	Ethyl t-Butyl Ether in Gasoline				12.78	2.01
2291	Ethyl t-Butyl Ether in Gasoline				17.18	2.70
2292	Methyl t-Butyl Ether in Gasoline				10.96	2.00
2293	Methyl t-Butyl Ether in Gasoline				14.86	2.71
2294	Reformulated Gasoline (nominal 11% MTBE, 35 mg/kg sulfur)				In Prep	
2295	Reformulated Gasoline (nominal 15% MTBE, 300 mg/kg sulfur)				In Prep	
2296	Reformulated Gasoline (nominal 13% ETBE, 35 mg/kg sulfur)				In Prep	
2297	Reformulated Gasoline (nominal 10% Ethanol, 300 mg/kg sulfur)				In Prep	

108. Metal Constituents in Fossil Fuels (liquid and solid forms)

These SRMs and RM are for analysis of metal trace elements in fuel oil and reference fuels. [Also see Category 114.]

SRM	Type	Unit Size	Elemental Composition (mass fraction, in %*)						
			As	Co	Pb	Ni	S	Se	V
1618	Vanadium and Nickel in Residual Fuel Oil (No. 6)	100 mL				75*	(4.3)		423*
1634c	Trace Elements in Fuel Oil (No. 6)	100 mL	0.1426*	0.1510*		17.54*	(2)	0.1020*	28.19*
2712	Lead in Reference Fuel	6×20 mL			11.4*				
2713	Lead in Reference Fuel	6×20 mL			19.4*				
2714	Lead in Reference Fuel	6×20 mL			28.1*				
2715	Lead in Reference Fuel	6×20 mL			784*				
RM 8505	Vanadium in Crude Oil	250 mL							(390*)

Values in parentheses are not certified and are given for information only.
*Values are in mg/kg.

108. Sulfur in Fossil Fuels (liquid and solid forms)

SRM	Type	Unit Size	Sulfur (mass fraction, in %)	Furnace Ash (mass fraction, in %)	Volatile Matter (mass fraction, in %)
1616a	Sulfur in Kerosine	100 mL	0.01462		
1617a	Sulfur in Kerosine	100 mL	0.17307		
1619a	Sulfur in Residual Fuel Oil	100 mL	0.725		
1620b	Sulfur in Residual Fuel Oil	100 mL	4.220		
1621e	Sulfur in Residual Fuel Oil	100 mL	0.9480		
1622e	Sulfur in Residual Fuel Oil	100 mL	2.1468		
1623c	Sulfur in Residual Fuel Oil	100 mL	0.0024		
1624c	Sulfur in Distillate Fuel Oil	100 mL	0.3970		
2717	Sulfur in Residual Fuel Oil	100 mL	3.022		
2723	Sulfur in Diesel Fuel Oil	100 mL	In Prep		
2724a	Sulfur in Diesel Fuel Oil	100 mL	0.04304		
1632b	Trace Elements in Coal (Bituminous)	50 g	1.89	6.8	(35)
1635	Trace Elements in Coal (Sub-bituminous)	50 g	0.33		
2718	Trace Elements in Green Petroleum Coke	50 g	In Prep		
2719	Trace Elements in Calcined Petroleum Coke	50 g	In Prep		
2682a	Coal (Sub-bituminous)	50 g	0.486	6.3	
2683b	Coal (Bituminous)	50 g	1.955	9.93	
2684a	Coal (Bituminous)	50 g	3.06	11.0	
2685a	Coal (Bituminous)	50 g	4.730	16.21	
2692a	Sulfur in Coal, 1%	50 g	1.184	7.94	
2775	Foundry Coke	50 g	0.5816	5.77	1.31
2776	Furnace Coke	In Prep			

Values in parentheses are not certified and are given for information only.

108. Moisture in Oils and Alcohols (liquid form)

These RMs are intended for use in developing and validating methods for the determination of moisture in oil and similar matrices. The water concentration values are not certified, but represent the "best estimate" of the moisture content determined by NIST.

RM	Type	Unit Size	Water Concentration (in mg/kg)
8506	Moisture in Transformer Oil	Set of 5 ampules: 10 mL each	(39.7)
8507	Moisture in Mineral Oil	Set of 5 ampules: 10 mL each	(76.8)
8509	Moisture in Methanol	Set of 5 ampules: 5 mL each	(93)
8510	Moisture in Methanol	Set of 5 ampules: 5 mL each	(325)

Values in parentheses are not certified and are given as recommended reference values only.

108. Reference Liquids for Evaluating Fuels

SRMs 1815a and 1816a are high purity liquids intended for use in maintaining the integrity of the octane rating of motor and aviation fuels as specified in the ASTM Manual for Rating Motor, Diesel, and Aviation Fuels.

SRM	Type	Unit Size	Purity (mass fraction, in %)
1815a	n-Heptane	100 mL	99.987
1816a	*Iso* octane (2,2,4-Trimethylpentane)	100 mL	99.987

108. Trace Elements (solid forms)

SRM	1632b	1633b	1635	2689	2690	2691	2718	2719
Type	Coal (Bituminous)	Coal Fly Ash	Coal (Subbitum-inous)	Coal Fly Ash	Coal Fly Ash	Coal Fly Ash	Green Petroleum Coke	Calcined Petroleum Coke
Unit Size	50 g	75 g	75 g	3×10 g	3×10 g	3×10 g	50 g	50 g
Element	(Concentrations are in mg/kg, unless noted by a single asterisk for mass fraction, in %.)							
Aluminum	0.855*	15.05*	(0.32*)	12.94*	12.35*	9.81*	In Prep	In Prep
Antimony	(0.24)	(6)	(0.14)	(9)	(6)	(3)		
Arsenic	3.72	136.2	0.42	(200)	(26)	(30)		
Barium	67.5	709		(800)	(5800)	(5900)		
Beryllium				(21)	(8)	(8)		
Bromine	(17)	(2.9)						
Cadmium	0.0573	0.784	0.03	(3)	(0.7)	(0.9)		
Calcium	0.204*	1.51*		2.18*	5.71*	18.45*		
Carbon	76.86*							
Cerium	(9)	(190)	(3.6)					
Cesium	(0.44)	(11)		(11)	(8)	(1)		
Chlorine	(1260)							
Chromium	(11)	198.2	2.5	(170)	(67)	(68)		
Cobalt	2.29	(50)	(0.65)	(48)	(19)	(26)		
Copper	6.28	112.8	3.6					
Dysprosium		(17)						
Europium	(0.17)	(4.1)	(0.06)	(3)	(2)	(2)		
Fluorine	41.7		25.9					
Gadolinium		(13)						
Gallium			(1.05)					
Hafnium	(0.43)	(6.8)	(0.29)	(7)	(8)	(10)		
Holmium		(3.5)						
Hydrogen	4.94*							
Iron (Total)	0.759*	7.78*	0.239*	9.32*	3.57*	4.42*		
Lanthanum	(5.1)	(94)						
Lead	3.67	68.2	1.9	(52)	(39)	(29)		
Lithium	(10)							
Lutetium		(1.2)						
Magnesium	0.0383*	0.482*		0.61*	1.53*	3.12*		
Manganese	12.4	131.8	21.4	(300)	(300)	(200)		
Mercury	(0.10)	0.141	(0.02)	(<0.003)	(<0.003)	(<0.003)		
Molybdenum	(0.9)							
Neodymium		(85)						
Nickel	6.10	120.6	1.74	(122)	(46)	(53)		
Nitrogen	1.56*							
Phosphorus		(2300)		0.10*	0.52*	0.51*		
Potassium	0.0748*	1.95*		2.20*	1.04*	0.34*		
Rubidium	5.50	(140)						
Samarium	(0.87)	(20)						
Scandium	(1.9)	(41)	(0.63)	(32)	(17)	(24)		
Selenium	1.29	10.26	0.9	(7)	(0.8)	(17)		
Silicon	(1.4*)	23.02*		24.06*	25.85*	16.83*		
Sodium	0.0515*	0.201*	(0.24*)	0.25*	0.24*	1.09*		
Strontium	(102)	1041		(700)	(2000)	(2700)		
Sulfur	1.89*	0.2075*	0.33*		0.15*	0.83*		
Tantalum		(1.8)						
Terbium		(2.6)						
Thallium		(5.9)						
Thorium	1.342	25.7	0.62	(25)	(25)	(26)		
Thulium		(2.1)						
Titanium	0.0454*	0.791*	(0.02*)	0.75*	0.52*	0.90*		
Tungsten	(0.48)	(5.6)						
Uranium	0.436	8.79	0.24					
Vanadium	(14)	295.7	5.2					
Ytterbium		(7.6)						
Zinc	11.89	(210)	4.7	(240)	(120)	(120)		

Values in parentheses are not certified and are given for information only.

109. Organics

109. GC/MS and LC System Performance (liquid form)

These SRMs and RM are for evaluating the sensitivity of gas chromatography/mass spectrometry (GC/MS) instrumentation and for characterizing liquid chromatography (LC) column selectivity.

SRM	Type	Unit Size	Selectivity (C18 phases)	Concentration (in mg/L) Low/High	
869	LC Selectivity	Set of 5, 1.1 mL	BaP≤PhPh<TBN		
1543	GC/MS System	Set of 4, 1 mL		Methyl Stearate	0.99/4.98
RM 8443	Performance	Set of 20, 1 mL		Benzophenone	1.01/5.01

109. Organic Constituents (liquid and solid forms)

These SRMs and RMs are for calibrating or measuring organic contaminants found in a variety of environmental matrices. They are listed in the table below and further described in tables on this and the following three pages. The first three tables identify the SRMs for PAHs, Pesticides, PCBs, methylmercury, and mercury, respectively. The SRMs described therein are grouped according to application — calibration or natural matrix measurement. The calibration SRMs are useful for validating the chromatographic separation step while the natural matrix SRMs, which are similar to actual environmental samples, can be used to validate all the steps of an analytical procedure. The fourth table describes SRMs and RMs certified for organic components in such matrices as oil, *iso*octane, and methanol. **NOTE:** Due to space limitations, only selected components are listed for most SRMs in the tables. Also, due to the types of components certified, SRMs 1588a, 1941a, 1945, 1974a, and 2974, are listed in more than one table.

SRM	Type	Unit of Issue
1491	Aromatic Hydrocarbons in Hexane/Toluene	Set of 5 ampules
1492	Chlorinated Pesticides in Hexane	Set of 5 ampules
1493	Polychlorinated Biphenyl Congeners in *Iso*octane	Set of 5 ampules
1580	Shale Oil	Set of 5 ampules
1581	Polychlorinated Biphenyls in Oil	Set of 8 ampules
1582	Petroleum Crude Oil	Set of 5 ampules
1584	Phenols in Methanol	Set of 5 ampules
1586	Isotopically Labelled Priority Pollutants	Set of 6 ampules
1587	Nitro PAH in Methanol	Set of 4 ampules
1588a	Organics in Cod Liver Oil	In Prep
1589a	Polychlorinated Biphenyls (as Aroclor 1260) in Human Serum	In Prep
1596	Dinitropyrene Isomers and 1-Nitropyrene in Methylene Chloride	Set of 5 ampules
1597	Complex Mixture of Polycyclic Aromatic Hydrocarbons from Coal Tar	Set of 4 ampules
1614	Dioxin (2,3,7,8 TCDD) in *Iso*octane	Set of 6 ampules
1639	Halocarbons (in Methanol) for Water Analysis	In Prep
1647d	Priority Pollutant Polycyclic Aromatic Hydrocarbons (in Acetonitrile)	Set of 5 ampules
1649a	Urban Dust/Organics	10 g
1650a	Diesel Particulate Matter	In Prep
1939a	Polychlorinated Biphenyls in River Sediment A	50 g
1941a	Organics in Marine Sediment	50 g
1944	New York-New Jersey Waterway Sediment	In Prep
1945	Organics in Whale Blubber	Set of 2 bottles
1974a	Organics in Mussel Tissue (Frozen)	Set of 3 bottles
1975	Diesel Particulate Extract	In Prep
2260	Aromatic Hydrocarbons in Toluene	Set of 5 ampules
2261	Chlorinated Pesticides in Hexane	Set of 5 ampules
2262	Chlorinated Biphenyl Congeners in *Iso*octane	Set of 5 ampules
2974	Organics in Freeze-dried Mussel	8 g
2975	Diesel Particulate Matter (Industrial Forklift)	In Prep
RM 8466	γ-HCH (Lindane) (neat)	Vial, 100 mg
RM 8467	4,4'-DDE (neat)	Vial, 100 mg
RM 8469	4,4'-DDT (neat)	Vial, 100 mg

109. Organic Constituents (liquid and solid forms) – Continued

PAH	Calibration Solution			Natural Matrix										
SRM	1491	2260	1647d	1580	1582	1597	1649a	1650a	1941a	1944	1974a	1975	2974	2975
[No. of Components certified]	[23]	[23]	[16]	[9]	[6]	[12]	[22]	[23]	[23]	[20]	[15]	[23]	[14]	[23]
Component (in mg/kg)														
Naphthalene	10.30	76.3	25.84			1160		In Prep	1.010	In Prep	0.0235	In Prep	(0.00963)	In Prep
1-Methylnaphthalene	12.4	75.7				(47)					(0.0053)		(0.00347)	
2-Methylnaphthalene	(11.3)	(75.3)				(97)					(0.0102)		(0.00648)	
Biphenyl	10.46	76.14				(27)			(0.175)		(0.00511)		(0.00468)	
Acenaphthylene	10.40	73.09	19.89			(250)			(0.037)		(0.00525)		(0.00460)	
Acenaphthene	10.89	78.9	26.67						(0.041)		(0.00315)		(0.00274)	
Fluorene	10.87	75.62	6.09			(140)	(0.231)		0.973		(0.00572)		(0.00469)	
Phenanthrene	10.48	76.01	4.40		101	462	4.14		0.489		0.0222		0.0222	
Anthracene	11.69	57.54	1.02			101	0.432		0.184		0.0061		0.0061	
1-Methylphenanthrene	10.4	75.2					(0.366)		(0.101)		(0.0105)		(0.0105)	
Fluoranthene	8.84	76.31	9.81	54	2.5	322	6.45		0.981		0.1637		0.1637	
Pyrene	8.81	76.20	10.88	104		235	5.29		0.811		0.1516		0.1516	
Benz[*a*]anthracene	5.37	66.0	5.25		3.0	98.6	2.21		0.427		0.0325		0.0325	
Chrysene	10.50	76.6	4.71			71.7	3.049		0.380		0.0442		0.0442	
Triphenylene						12.1	1.357		0.197		0.0507		0.0507	
Benzo[*b*]fluoranthene	7.85	75.97	5.36			(66)	6.43		0.740		0.0464		0.0464	
Benzo[*k*]fluoranthene	8.33	75.67	6.06			(43)	1.907		0.361		0.02018		0.0202	
Benzo[*a*]fluoranthene							0.409		0.118		(0.0040)			
Benzo[*e*]pyrene	8.40	75.98		18			(57)	3.09		0.553	0.0840		0.0840	
Benzo[*a*]pyrene	10.14	68.61	6.31	21	1.1	95.8	2.509		0.628		0.01563		0.01563	
Perylene	10.65	57.48		3.4	31	26.1	0.646		0.452		0.00768		0.00768	
Indeno[1,2,3–*cd*]pyrene	9.40	67.4	5.49			60.2	3.08		0.501		0.0142		0.0142	
Dibenz[*a*,*h*]anthracene	7.74	57.1	4.54				0.299		0.0739					
Benzo[*ghi*]perylene	7.90	67.9	4.73			53.7	3.99		0.525		0.0220		0.0220	

Values in parentheses are not certified but are provided as reference values or are given for information only.

109. Organic Constituents (liquid and solid forms) – Continued

Pesticide	Calibration Solution		Natural Matrix					
SRM	1492	2261	1588a	1941a	1944	1945	1974a	2974
[No. of Components certified]	[15]	[15]	[12]	[6]	[10]	[15]	[7]	[7]
Component (in µg/kg)								
Hexaclorobenzene	308	3005	In Prep	70		32.9		
γ-HCH (Lindane)	310	3012				3.30		
Heptachlor	299	3020						
Aldrin	304	3029						
Heptachlor epoxide	307	3020				10.8		
cis-Chlordane	305	3012		2.33		46.9	17.2	17.2
trans-Nonachlor	297	3034		1.26		231	18.0	18.0
Dieldrin	307	3012		(1.26)		(37.5)	(6.2)	(6.2)
Mirex	306	3041				28.9		
2,4'-DDE	303	3019		0.73		12.28	(5.26)	(5.26)
4,4'-DDE	306	3019		6.59		445	51.2	51.2
2,4'-DDD	299	3013				18.1	(13.7)	(13.7)
4,4'-DDD	296	3043		5.06		133	43.0	43.0
2,4'-DDT	307	2993				106	(8.5)	(8.5)
4,4'-DDT	302	3004		(1.25)		245	3.91	3.91

Values in parentheses are not certified and are given for information only.

109. Organic Constituents (liquid and solid forms) – Continued

PCB	Calibration Solution		Natural Matrix							
SRM	1493	2262	1588a	1589a	1939a	1941a	1944	1945	1974a	2974
[No. of Components certified]	[18]	[25]	[15]	[tbd]*	[16]	[21]	[20]	[27]	[20]	[26]
Component (in µg/kg)										
Methylmercury									77.3	77.3
Mercury									176	176
PCB 1		2997	In Prep	In Prep	In Prep		In Prep			
PCB 3										
PCB 8	(277)	3110				(1.39)				
PCB 15										
PCB 18	290.8	2983				(1.15)		4.48	(33)	(26.8)
PCB 28	288.0	(3000)				(9.8)		(14.1)	(79)	(79)
PCB 29		2980								
PCB 44	289	2977				4.80		12.2	72.7	72.7
PCB 50		(3010)								
PCB 52	285.9	2996				6.89		43.6	115	115
PCB 66	291.9	2973				6.8		23.6	101.4	101.4
PCB 77	284.3	3040								
PCB 87		3000				6.70		16.7	(54)	
PCB 101	287.8	2950				11.0		65.2	128.3	128
PCB 104		3007								
PCB 105	286	2960				3.65		30.1	53.0	53.0
PCB 118	(289)	2992				10.0		74.6	130.8	130.8
PCB 126	287.4	3010								
PCB 128	290.0	2985				1.87		23.7	22.0	22.0
PCB 138	287.1	2939				13.38		131.5	133.5	134
PCB 153	287.5	2957				17.6		213	145.2	145.2
PCB 154		(2950)								
PCB 170	285.3	2964				3.00		40.6	5.5	5.5
PCB 180	289.2	2986				5.83		106.7	17.1	17.1
PCB 187	285.3	2967				(7.0)		105.1	34.0	34.0
PCB 188		3008								
PCB 195	289.0	2974						17.7		
PCB 201		3001						16.96		
PCB 206	259	2900				3.67		31.1		
PCB 209	289.6	2989				8.34		10.6		

Values in parentheses are not certified but are provided as reference values or are given for information only..
*Components to be certified are yet to be determined.

109. Organic Constituents (liquid and solid forms) – Continued

Selected Matrices SRM [No. of Components certified]	1581 [4]	1584 [10]	1586-1 [10]	1586-2 [10]	1587 [6]	1596 [4]	1614 [2]	1639 [7]	RM 8466	RM 8467	RM 8469
Component (Concentrations are in mg/kg, unless noted by a single asterisk for µg/kg, a double asterisk for mg/L @ 25 °C, or a dagger for mass fraction, in %.)											
Motor Oil-Aroclor 1242	100										
Motor Oil-Aroclor 1260	100										
Transformer Oil-Aroclor 1242	100										
Transformer Oil-Aroclor 1260	100										
2-Chlorophenol		64.4**									
Phenol		29.7**	117.0	116.0							
2-Nitrophenol		25.2**	103.6	101.9							
2,4-Dimethylphenol		51.6**									
2,4-Dichlorophenol		35.6**	102.5	82.2							
4-Chloro-m-cresol		27.4**									
2,4,6-Trichlorophenol		20.4**									
4-Nitrophenol		20.7**									
4,6-Dinitro-o-cresol		20.1**									
Pentachlorophenol		15.4**									
2,4-Dinitrophenol		(22.4)**									
Carbon Tetrachloride			128.5	124.4				157.0**			
Benzene			101.1	99.0							
Chlorobenzene			133.0	144.0							
Nitrobenzene			126.0	134.5							
Naphthalene			126.5	126.6							
Bis(2-ethylhexyl)phthalate			63.9	60.4							
Benzo[*a*]pyrene			49.2	44.1							
2-Nitrofluorene					9.67						
9-Nitroanthracene					5.01						
3-Nitrofluoranthene					9.24						
1-Nitropyrene					8.95	4.38					
7-Nitrobenz[*a*]anthracene					9.27						
6-Nitrochrysene					8.13						
6-Nitrobenzo[*a*]pyrene					(6.1)						
1,3-Dinitropyrene						2.10					
1,6-Dinitropyrene						4.82					
1,8-Dinitropyrene						8.90					
2,3,7,8-TCDD							98.3*				
2,3,7,8-TCDD-^{13}C							95.6*				
Chloroform								6235 **			
Chlorodibromomethane								124.6**			
Bromodichloromethane								389.9**			
Bromoform								86.5**			
Trichloroethylene								85.8**			
Tetrachloroethylene								40.6**			
γ-Hexachlorocyclohexane (Lindane)									(99.9)†		
4,4'-DDE										(99.8)†	
4,4'-DDT											(99.8)†

Values in parentheses are not certified and are given for information only.

110. Food and Agriculture

These SRMs are for validation of analytical procedures and calibration of apparatus used in the analysis of trace elements in foods and related products.

Foods and Beverages (liquid and powder forms)

SRM	1549	1566b	1567a	1568a	1577b
Type	Non-fat Milk Powder	Oyster Tissue	Wheat Flour	Rice Flour	Bovine Liver
Unit Size	100 g	25 g	80 g	80 g	50 g
Element	**(Concentrations are in mg/kg, unless noted by a single asterisk for mass fraction, in %.)**				
Aluminum	(2)	In Prep	5.7	4.4	(3)
Antimony	(0.00027)			(0.0005)	(0.003)
Arsenic	(0.0019)		(0.006)	0.29	(0.05)
Bromine	(12)		(6)	(8)	(9.7)
Cadmium	0.0005		0.026	0.022	0.50
Calcium	1.30*		0.0191*	0.011*	116
Chlorine	1.09*		(565)	(300)	0.278*
Chromium	0.0026				
Cobalt	(0.0041)		(0.006)	(0.018)	(0.25)
Copper	0.7		2.1	2.4	160
Fluorine	(0.20)				
Iodine	3.38		(0.0009)	(0.009)	
Iron	1.78		14.1	7.4	184
Lead	0.019		(<0.020)	(<0.010)	0.129
Magnesium	0.120*		0.040*	0.056*	601
Manganese	0.26		9.4	20.0	10.5
Mercury	0.0003		(0.0005)	0.0058	(0.003)
Molybdenum	(0.34)		0.48	1.46	3.5
Nickel				(0.16)	
Nitrogen					
Phosphorus	1.06*		0.134*	0.153*	1.10*
Potassium	1.69*		0.133*	0.1280*	0.994*
Rubidium	(11)		0.68	6.14	13.7
Selenium	0.11		1.1	0.38	0.73
Silicon	(<50)				
Silver	(<0.0003)				0.039
Sodium	0.497*		6.1	6.6	0.242*
Strontium					0.136
Sulfur	0.351*		0.165*	0.120*	0.785*
Tellurium				(<0.002)	
Thorium					
Tin	(<0.02)			(0.0033)	(0.0047)
Uranium			(0.0003)	(0.0003)	
Vanadium			(0.011)	(0.007)	(0.123)
Zinc	46.1		11.6	19.4	127

Values in parentheses are not certified and are given for information only.

110. Health Care and Nutrients (liquid and solid forms)

These SRMs and RMs are for use in determining the nutritional contents of foods. The SRMs are certified for such dietary constituents as proximates (solids, ash, protein, carbohydrate, fat and linoleate), vitamins, niacin, folic acid, pantothenic acid, biotin, choline, and selected minerals and trace elements. **NOTE:** Only selected constituent values are shown below for information. Consult the relevant certificate or report of investigation for all available certified and non-certified values.

SRM	Type	Certified Constituents		Unit Size
		Analytes	Values	
Nutritional Constituent	(Concentrations are in g/kg, unless noted by a single asterisk for mg/kg.)			
1544	Fatty Acids and Cholesterol in a Frozen Diet Composite	Cholesterol, Fatty Acids, Proximates	0.1483	4×15 g
1548a	Typical Diet	In Prep		2×6.5 g
1563	Cholesterol and Fat-Soluble Vitamins in Coconut Oil	Cholesterol	639.8	10 ampules; 5 fortified
		Ergocalciferol	10.9*	5 natural
		dl-α-Tocopherol Acetate	158.0*	
1845	Whole Egg Powder	Cholesterol	19.0 g/kg	35 g
1846	Infant Formula (milk-based)	Proximates, Vitamins, Minerals		10×30 g
2383	Baby Food Composite	Carotenoids, Vitamins		4×70 g
RM 8036	BCR No 150 Spiked Skim Milk Powder	Trace Elements		30 g
RM 8435	Whole Milk	Minerals		40 g

110. USA/Canada Collaborative Materials (powder form)

These materials, developed by Agriculture Canada in collaboration with NIST, are for calibrating apparatus and validating methods applied to food/agricultural commodities.

RM	8412	8413	8414	8415	8416	8418
Type	Corn Stalk	Corn Kernel	Bovine Muscle Powder	Whole Egg Powder	Microcrystalline Cellulose	Wheat Gluten
Unit Size	34 g	47 g	50 g	35 g	35 g	50 g
Element	(Best Estimate concentrations are in mg/kg, unless noted by a single asterisk for mass fraction, in %.)					
Aluminum	–	(4)	1.7	540	3.7	10.8
Antimony	–	–	(0.01)	(0.002)	–	(0.01)
Arsenic	–	–	0.009	(0.01)	(0.001)	(0.02)
Barium	–	–	(0.05)	(3)	(0.1)	1.53
Boron	–	–	0.6	0.41	(0.2)	(0.4)
Bromine	–	–	1.1	–	–	(3.6)
Cadmium	–	–	0.013	(0.005)	0.00002	0.064
Calcium	0.216*	42	145	0.248*	(5)	369
Cerium	–	–	–	–	–	–
Cesium	–	–	(0.05)	–	–	–
Chlorine	0.244*	(450)	0.188*	0.508*	80	0.362*
Chromium	–	–	0.071	0.37	(0.05)	0.053
Cobalt	–	–	0.007	0.012	0.0017	0.010
Copper	8	3.0	2.84	2.70	0.015	5.94
Fluorine	(0.65)	(0.24)	(0.22)	–	(0.005)	(0.43)
Iodine	–	–	0.035	1.97	(0.01)	0.060
Iron	139	23	71.2	112	(2)	54.3
Lanthanum	–	–	–	–	–	–
Lead	–	–	0.38	0.061	0.006	0.10
Magnesium	0.160*	0.0990*	960	305	–	510
Manganese	15	4.0	0.37	1.78	(0.03)	14.3
Mercury	–	–	0.005	0.004	(0.0002)	0.0019
Molybdenum	–	–	0.08	0.247	0.01	0.76
Nickel	–	–	0.05	–	0.05	0.13
Nitrogen	(6970)	(13750)	13.75	6.30	200	14.68
Phosphorus	–	–	0.836	1.001	(7)	0.219
Potassium	1.735	0.3570	1.517	0.319	–	472
Rubidium	–	28.7	–	–	–	(0.4)
Samarium	–	–	–	–	–	–

110. USA/Canada Collaborative Materials (powder form) — Continued

RM	8412	8413	8414	8415	8416	8418
Type	Corn Stalk	Corn Kernel	Bovine Muscle Powder	Whole Egg Powder	Microcrystalline Cellulose	Wheat Gluten
Unit Size	34 g	47 g	50 g	35 g	35 g	50 g
Element	(Best estimate concentrations are in mg/kg, unless noted by a single asterisk for mass fraction, in %.)					
Selenium	0.016	0.004	0.076	1.39	0.002	2.58
Sodium	28	–	0.210	0.377	(7)	0.142
Strontium	12	–	0.052	5.63	(0.02)	1.71
Sulfur	–	–	0.795	0.512	(10)	0.845
Titanium	–	–	–	–	–	(2)
Vanadium	–	–	(0.005)	0.459	(0.02)	(0.04)
Zinc	32	15.7	142	67.5	0.1	53.8

Values in parentheses are not certified and are given for information only.

RM	8432	8433	8435	8436	8437	8438
Type	Corn Starch	Corn Bran	Whole Milk Powder	Durum Wheat Flour	Hard Red Spring Wheat Flour	Soft Winter Wheat Flour
Unit Size	50 g	50 g	40 g	50 g	50 g	50 g
Element	(Best estimate concentrations are in mg/kg, unless noted by a single asterisk for mass fraction, in %.)					
Aluminum	1.9	1.01	0.9	11.7	2.1	2.3
Antimony	–	(0.004)	–	–	–	–
Arsenic	–	0.002	(0.001)	(0.03)		
Barium	–	2.40	0.58	2.11	(0.04)	(1)
Boron	–	2.8	1.1	–	(0.2)	(0.1)
Bromine	–	2.3	20	6.6	–	–
Cadmium	0.0003	0.012	(0.0002)	0.11	(0.02)	(0.03)
Calcium	56	420	0.922	278	143	240
Chlorine	45	31	0.842*	680	500	640
Chromium	(0.02)	0.101	(0.5)	0.023	0.026	0.032
Cobalt	0.0012	0.006	(0.003)	0.008	–	–
Copper	0.06	2.47	0.46	4.30	2.01	1.2
Fluorine	(0.02)	–	(0.17)	(0.1)	(0.02)	(0.04)
Iodine	–	0.026	2.3	0.006	–	–
Iron	(5)	14.8	1.8	41.5	31	29
Lead	0.007	0.140	0.11	0.023	–	–
Magnesium	31	818	814	0.107*	365	214
Manganese	0.10	2.55	0.17	16.0	4.50	5.4
Mercury	0.0011	0.003	–	0.004	(0.004)	(0.002)
Molybdenum	0.02	0.252	0.29	0.70	0.55	0.29
Nickel	0.02	0.158	(0.01)	0.17	(0.2)	–
Nitrogen	670	0.884*	4.182*	2.707*	2.690*	1.756*
Phosphorus	178	171	0.780*	0.290*	0.137*	0.108
Potassium	45	566	1.363*	0.318*	0.115*	0.148*
Rubidium	–	0.5	(16)	2.0	–	–
Selenium	0.0009	0.045	0.131	1.23	0.56	0.076
Sodium	119	430	0.356*	16.0	7	7
Strontium	0.18	4.62	4.35	1.19	(4)	–
Sulfur	(200)	860	0.265*	0.193*	0.183*	0.126*
Titanium	–	–	(4)	(5)	–	–
Tungsten	(0.001)	–	(0.002)	–	(0.01)	–
Vanadium	–	0.005	–	0.021	0.02	(0.03)
Zinc	0.22	18.6	28.0	22.2	10.6	5.8

Values in parentheses are not certified and are given for information only.

110. Agricultural Materials (powder form)

SRM	1515	1547	1570a	1573a	1575	2695	RM 8030	RM 8031	RM 8412	RM8413
Type	Apple Leaves	Peach Leaves	Spinach Leaves	Tomato Leaves	Pine Needles	Fluoride, in Vegetation	BCR No 60 Aquatic Plant	BCR No 61 Aquatic Moss	Corn Stalk (Zea Mays)	Corn Kernel (Zea Mays)
Unit Size	50 g	50 g	60 g	50 g	70 g	2 × 25 g	25 g	25 g	34 g	47 g
Element	(Concentrations are in mg/kg, unless noted by a single asterisk for mass fraction, in %.)									
Aluminum	286	249	310	598	545					(4)
Antimony	(0.013)	(0.02)		0.063	(0.2)					
Arsenic	0.038	0.060	0.068	0.112	0.21					
Barium	49	124		(63)						
Boron	27	29	37.6	33.3						
Bromine	(1.8)	(11)		(1300)	(9)					
Cadmium	(0.013)	(0.026)	2.89	1.52	(<0.5)		(2.20)	(1.07)		
Calcium	1.526*	1.56*	1.527*	5.05*	0.41*				(0.216*)	(42)
Cerium	(3)	(10)		(2)	(0.4)					
Cesium				(53)						
Chlorine	579	360		(6600)					(0.244*)	(450)
Chromium	(0.3)	(1)		1.99	2.6					
Cobalt	(0.09)	(0.07)	0.39	0.57	(0.1)					
Copper	5.64	3.7	12.2	4.70	3.0		(51.2)	(720)	(8)	(3.0)
Europium	(0.2)	(0.17)	(0.0054)		(0.006)					
Fluorine						64/277			(0.65)	(0.24)
Gadolinium	(3)	(1)		(0.17)						
Gold	(0.001)									
Hydrogen		5.2*								
Iodine	(0.3)	(0.3)		(0.85)						
Iron	(83)	(218)		368	200				(139)	(23)
Lanthanum	(20)	(9)		(2.3)	(0.2)					
Lead	0.470	0.87	(0.20)		10.8		(63.8)	(64.4)		
Magnesium	0.271*	0.432*	(0.89*)	(1.2*)					(0.160*)	(0.0990*)
Manganese	54	98	75.9	246	675		(1759)	(3771)	(15)	(4.0)
Mercury	0.044	0.031	0.030	0.034	0.15		(0.34)	(0.23)		
Molybdenum	0.094	0.060		(0.46)						
Neodymium	(17)	(7)								
Nickel	0.91	0.69	2.14	1.59	(3.5)					
Nitrogen	2.25*	2.94*	5.90*	3.03*	(1.2*)				(6970)	(13750)
Phosphorus	0.159*	0.137*	0.518*	0.216*	0.12*					
Potassium	1.61*	2.43*	2.903*	2.70*	0.37*				(1.735*)	(0.357*)
Rubidium	10.2	19.7	(13)	14.89	11.7					
Samarium	(3)	(1)		(0.19)						
Scandium	(0.03)	(0.04)	(0.055)	(0.1)	(0.03)					
Selenium	0.050	0.120	0.117	0.054					(0.016)	(0.004)
Sodium	24.4	24	1.818*	136					(28)	
Strontium	25	53	55.6	(85)	4.8				(12)	
Sulfur	(0.18*)	(0.2*)	(0.46*)	(0.96*)						
Tellurium										
Terbium	(0.4)	(0.1)								
Thallium					(0.05)					
Thorium	(0.03)	(0.05)	0.48	(0.12)	0.037					
Tin	(<0.2)	(<0.2)								
Tungsten	(0.007)									
Uranium	(0.006)	(0.015)	(0.15)	(35)	0.020					
Vanadium	0.26	0.37	0.57	0.835						
Ytterbium	(0.3)	(0.02)								
Zinc	12.5	17.9	82	30.9			(313)	(566)	(32)	(15.7)

Values in parentheses are not certified and are given for information or as recommended values only.

110. Fertilizers (powder form)

These SRMs are intended for use in the fertilizer industry as working standards.

SRM	Type	Unit Size (in g)	Composition (mass fraction, in %)					
			N	P	K	P_2O_5	K_2O	CaO
120c	Phosphate Rock (Florida)	90				33.34	0.147	48.02
193	Potassium Nitrate	90	13.85		38.66			
194	Ammonium Dihydrogen Phosphate	90	12.15	26.92				
200a	Potassium Dihydrogen Phosphate	In Prep						
694	Phosphate Rock (Western)	90				30.2	0.51	43.6

SRM	SiO_2	F	Fe_2O_3	Al_2O_3	MgO	Na_2O	MnO	TiO_2	Cr_2O_3	CdO	U	V_2O_5
694	11.2	3.2	0.79	1.8	0.33	0.86	0.0116	(0.11)	(0.10)	0.015	0.01414	0.31

Values in parentheses are not certified and are given for information only.

110. Wheat Hardness (kernel form)

This RM is intended primarily for calibrating instruments used to determine the hardness of bulk or single kernel wheat. RM 8441 was prepared and analyzed by the Federal Grain Inspection Service program, Grain Inspection Packers and Stockyards Administration of the United States Department of Agriculture.

RM	Type	Unit Size
8441	Wheat Hardness	Hard-1 through Hard-5 5×5 pouches each (20 g/pouch) Soft-1 through Soft-5 5×5 pouches each (20 g/pouch)

111. Geological Materials and Ores

111. Chinese Ores (powder form)

These RMs are a series of skarn deposit ores developed and certified by the Hubei Geological Research Laboratory, Hubei Province, China. Skarn ores are common in the Pacific area and other parts of the world. These RMs can be used as control samples in geochemical exploration and in environmental monitoring programs.

NOTE: In addition to the listed constituent elements, elemental concentrations are given for all major rock-forming oxides and many trace elements, including the rare earth elements and toxic trace elements important to environmental assessment programs.

RM	8600	8601	8603	8604	8605	8606	8607	8608
Type	Copper	Copper	Lead	Zinc	Molybdenum	Molybdenum	Tungsten	Tungsten
Unit Size (in g)	100	100	100	100	100	100	100	100
Element (mass fraction, in %)								
Cu	1.15	0.19	0.035	0.71			0.079	0.096
Mo					1.51	0.11		
Pb			0.61	0.25				
S	0.72	0.14	0.38	2.87	1.64	0.48	3.12	1.90
W					0.36	0.10	0.015	0.22
Zn	0.059	0.013	0.092	2.75			0.29	0.010

111. Ores (powder form)

SRM	79a	113b	180	181	182	183	277	330	331	2430
Type	Fluorspar, Customs Grade	Zinc Concentrate	Fluorspar, High Grade	Lithium Ore (Spodumene)	Lithium Ore (Petalite)	Lithium Ore (Lepidolite)	Tungsten Concentrate	Copper Ore Mill Heads	Copper Ore Mill Tails	Scheelite Ore
Unit Size (in g)	120	100	120	45	45	45	100	100	100	100
Component (Concentrations are mass fractions, in %, unless noted by an asterisk for mg/kg)										
Ca		0.8196					(0.37)			**As 0.002**
CaF_2	97.39		98.80							
Cd		0.7804								
Cu		0.2953						0.84	0.091	(0.01)
Fe		2.077					(7.4)			(1.0)
Au								(0.093*)	(0.034*)	
Hg		(0.55*)								
Li_2O				6.39	4.34	4.12				
Mg		0.4460								
Mn							(10.0)			(0.12)
Mo							(0.06)	0.018	0.0022	0.22
Nb							(1.00)			
O_2							(21.4)			**Al (0.4)**
P							(0.03)			0.017
Pb		2.731					(0.07)			**Bi 0.078**
Re								0.30*	0.04*	
Si							(0.85)			**Mg (0.5)**
Ag		0.04607						(1.51*)	(0.243*)	
S		30.032					(0.25)			0.26
Ta							(0.20)			(<0.01)
Sn							(0.54)			**K (0.16)**
Ti							(2.2)			**Na (0.02)**
WO_3							67.4			70.26
Zn		56.49								

Values in parentheses are not certified and are given for information only.

111. Ores (powder form) – Continued

SRM	25d	27f	69b	120c	600	670	690	691	692	693
Type	Manganese Ore	Iron Ore, Sibley	Bauxite, Arkansas	Phosphate Rock, Florida	Bauxite, Australian	Rutile Ore	Iron Ore, Canada	Iron Oxide, Reduced	Iron Ore, Labrador	Iron Ore, Nimba
Unit Size (in g)	100	80	60	90	90	90	100	100	100	100
Component (Concentrations are mass fractions, in %, unless noted by an asterisk for mg/kg).										
Al_2O_3	5.32	0.82	48.8	1.30	40.0		0.18	1.22	1.41	1.02
BaO	(0.21)		(0.008)							
CdO				0.0010						
CaO	(0.052)	0.039	0.13	48.02	0.22		0.20	0.63	0.023	0.016
Co			(0.0001)					0.030		
Cu								0.032		
Cr_2O_3			0.011		0.024	0.23				
Total Fe		65.97					66.85	90.8	59.58	65.11
Fe_2O_3	3.92		7.14	1.08	17.0	0.86				
MgO		0.019	0.085	0.32	0.05		0.18	0.52	0.035	0.013
MnO	**Mn 51.78**	0.011	0.110	0.027	0.013		0.23	0.043	0.46	0.091
P		0.041					0.011	0.006	0.039	0.056
P_2O_5	0.25		0.118	33.34	0.039					
K_2O	0.93	0.008	0.068	0.147	0.23		0.0030		0.039	0.0028
SiO_2	2.52	4.17	13.43	5.5	20.3	0.51	3.71	3.7	10.14	3.87
Na_2O		0.012	(0.025)	0.52	0.022		0.003	0.186	0.008	0.0028
S		0.005					0.003	0.008	0.005	0.005
SO_3			0.551		0.155					
TiO_2	0.13	0.019	1.90	0.103	1.31	96.16	0.022	0.27	0.045	0.035
V_2O_5			0.028	0.016	0.060	0.66				
ZnO			0.0035	**CO_2 3.27**	0.003			**C 0.12**		
ZrO_2			0.29	**F 3.82**	0.060	0.84				
Oxygen, Available	14.28									
Moisture	(0.96)									
Loss on Ignition			27.2		20.5					

Values in parentheses are not certified and are given for information only.

111. Ores (powder form) – Continued

SRM	694	696	697	698	699	886	1835
Type	Phosphate Rock, Western	Bauxite, Surinam	Bauxite, Dominican	Bauxite, Jamaican	Alumina (reduction grade)	Gold Ore, Refractory	Borate Ore
Unit Size (in g)	90	60	60	60	60	200	60
Component (Concentrations are mass fractions, in %, unless noted by an asterisk for mg/kg).							
Al_2O_3	1.8	54.5	45.8	48.2		**Au 8.25***	3.474
BaO		(0.004)	(0.015)	(0.008)			0.0497
C_{Total}						(5.7)	
CdO	0.015						
CaO	43.6	0.018	0.71	0.62	0.036		21.622
Co	**F 3.2**	(0.00009)	(0.0013)	(0.0045)			**F 0.348**
Cr_2O_3	(0.10)	0.047	0.100	0.080	0.0002		
Fe_2O_3	0.79	8.70	20.0	19.6	0.013		1.141
MgO	0.33	0.012	0.18	0.058	0.0006		3.411
MnO	0.0116	0.004	0.41	0.38	0.0005		0.0333
P_2O_5	30.2	0.050	0.97	0.37	0.0002		
K_2O	0.51	0.009	0.062	0.010			1.261
SiO_2	11.2	3.79	6.81	0.69	0.014		18.408
Na_2O	0.86	(0.007)	(0.036)	(0.015)	0.59		3.484
S_{Total}						1.466	
SO_3		0.15	0.077	0.143			1.477
TiO_2	(0.11)	2.64	2.52	2.38			0.1332
U	0.01414						
V_2O_5	0.31	0.072	0.063	0.064	0.0005		
ZnO	(0.19)	0.0014	0.037	0.029	0.013		
ZrO_2		0.14	0.065	0.061			**SrO 0.9418**
Ga_2O_3					0.010		**B_2O_3 18.739**
Li_2O					0.002		
Loss on Ignition – See certificate for conditions		29.9	22.1	27.3	0.69		25.72

Values in parentheses are not certified and are given for information only.

111. Ore Bioleaching Substrate (powder form)

This RM is for use as a bioleaching substrate and for testing bioleaching rates. The material consists of pyrite from New Mexico. Thiobacillus ferrooxidans was used in the determinations.

RM	Type	Unit Size (in g)	Bioleaching Rate (in mg Fe/L/hr)
8455	Pyrite Ore	100	12.4

111. Clays (powder form)

SRM	97b	98b	679
Type	Flint Clay	Plastic Clay	Brick Clay
Unit Size (in g)	60	60	75
Element (Concentrations are mass fractions, in %, unless noted by an asterisk for mg/kg).			
Aluminum	20.76	14.30	11.01
Antimony	(2.2)*	(1.6)*	
Barium	(0.018)	(0.07)	0.0432
Calcium	0.0249	0.0759	0.1628
Cerium			(105)*
Cesium	(3.4)*	(16.5)*	(9.6)*
Chromium	227*	119*	109.7*
Cobalt	(3.8)*	(16.3)*	(26)*
Europium	(0.84)*	(1.3)*	(1.9)*
Hafnium	(13)*	(7.2)*	(4.6)*
Iron	0.831	1.18	9.05
Lithium	550*	215*	71.7*
Magnesium	0.113	0.358	0.7552
Manganese	47*	116*	(1730)*
Phosphorus	(0.02)	(0.03)	(0.075)
Potassium	0.513	2.81	2.433
Rubidium	(33)*	(180)*	(190)*
Scandium	(22)*	(22)*	(22.5)*
Silicon	19.81	26.65	24.34
Sodium	0.0492	0.1496	0.1304
Strontium	84*	189*	73.4*
Thorium	(36)*	(21)*	(14)*
Titanium	1.43	0.809	0.577
Zinc	(87)*	(110)*	(150)*
Zirconium	(0.05)	(0.022)	
Loss on Ignition (At 1100 °C, 2 hours; sample previously dried.)	(13.3)	(7.5)	

Values in parentheses are not certified and are given for information only.

111. Rocks and Minerals (powder form)

SRM	1c	70a	81a	88b	99a	165a	278	688	1413
Type	Lime-stone, Argilla-ceous	Feld-spar, Potash	Glass Sand	Limestone, Dolomite	Feld-spar, Soda	Glass Sand (low iron)	Obsidian Rock	Basalt Rock	Glass Sand (high alumina)
Unit Size (in g)	50	40	75	75	40	75	35	60	75
Component	(Concentrations are mass fractions, in %, unless noted by an asterisk for mg/kg).								
Al_2O_3	1.30	17.9	0.66	0.336	20.5	0.059	14.15	17.36	9.90
BaO		0.02		CO_2 **46.37**	0.26		**Ba (1140*)**		0.12
CaO	50.3	0.11		29.95	2.14		0.983	(12.17)	0.74
Cr_2O_3			46*			(1*)	**Cr (6.1*)**	**Cr 332***	
Fe_2O_3†	0.55	0.075	0.082	0.277	0.065	0.012	2.04	10.35	0.24
FeO†							1.36	7.64	
MgO	0.42			21.03	0.02		(0.23)	(8.4)	0.06
MnO	0.025			0.0160			0.052	0.167	
P_2O_5	0.04			0.0044	0.02		0.036	0.134	
K_2O	0.28	11.8		0.1030	5.2		4.16	0.187	3.94
Rb_2O		0.06					**Rb 127.5***	**Rb 1.91***	
SiO_2	6.84	67.12		1.13	65.2		73.05	48.4	82.77
Na_2O	0.02	2.55		0.0290	6.2		4.84	2.15	1.75
SrO	0.030			0.0076			**Sr 63.5***	**Sr 169.2***	
TiO_2	0.07	0.01	0.12	(0.016)	0.007	0.011	0.245	1.17	0.11
ZrO_2			0.034			0.006			
Loss on Ignition – See certificate for conditions	39.9	0.40		(46.98)	0.26				

Values in parentheses are not certified and are given for information only.
†Refer to certificate to ascertain if the value reported represents total iron or species-specific iron.

111. Refractories (powder form)

SRM	76a	77a	78a	154b	198	199
Type	Burnt Refractory (Al_2O_3–40%)	Burnt Refractory (Al_2O_3–60%)	Burnt Refractory (Al_2O_3–70%)	Titanium Dioxide	Silica Brick	Silica Brick
Unit Size (in g)	75	75	75	90	45	45
Component	(mass fraction, in %)					
Al_2O_3	38.7	60.2	71.7		0.16	0.48
CaO	0.22	0.05	0.11	(~0.01)	2.71	2.41
FeO†						
Fe_2O_3†	1.60	1.00	1.2	(0.006)	0.66	0.74
Li_2O	0.042	0.025	0.12		0.001	0.002
MgO	0.52	0.38	0.70	(~0.01)	0.07	0.13
MnO					0.008	0.007
P_2O_5	0.120	0.092	1.3	(0.04)	0.022	0.015
K_2O	1.33	0.090	1.22		0.017	0.094
SiO_2	54.9	35.0	19.4	(0.01)		
Na_2O	0.07	0.037	0.078		0.012	0.015
SrO	0.037	0.009	0.25			
TiO_2	2.03	2.66	3.22	99.74	0.02	0.06
ZrO_2						
Loss on Ignition	(0.34)	(0.22)	(0.42)		0.21	0.17

Values in parentheses are not certified and are given for information only.
†Refer to certificate to ascertain if the value reported represents total iron or species-specific iron.

111. Soils, Sediments, and Sludges (powder form)

SRM	1646a	2704a	2709**	2710**	2711**	2781**	2782	RM 8407
Type	Estuarine Sediment	Buffalo River Sediment	San Joaquin Soil	Montana Soil Highly Elevated Traces	Montana Soil Moderately Elevated Traces	Domestic Sludge	Industrial Sludge	Tennessee River Sediment
Unit Size	75 g	50 g	50 g	50 g	50 g	40 g		25 g
Element	(Concentrations are in mg/kg, unless noted by an asterisk for mass fraction, in %).							
Aluminum	2.297*	In Prep	7.50*	6.44*	6.53*	(1.6)	In Prep	
Antimony	(0.3)		7.9	38.4	19.4			
Arsenic	6.23		17.7	626	105	7.82		
Barium	(210)		968	707	726			
Beryllium	(<1)							
Bromine				(6)	(5)			
Cadmium	0.148		0.38	21.8	41.7	12.78		
Calcium	0.519*		1.89*	1.25*	2.88*	(3.9)		
Carbon			(1.2*)	(3 *)	(2 *)			
Cerium	(34)		(42)	(57)	(69)			
Cesium			(5.3)	(107)	(6.1)			
Chlorine								
Chromium	40.9		130	(39)	(47)	(202)		
Cobalt	(5)		13.4	(10)	(10)			
Copper	10.01		34.6	2950	114	627.4		
Dysprosium			(3.5)	(5.4)	(5.6)			
Europium			(0.9)	(1)	(1.1)			
Gallium	(5)		(14)	(34)	(15)			
Germanium								
Gold			(0.3)	(0.6)	(0.03)			
Hafnium			(3.7)	(3.2)	(7.3)			
Holmium			(0.54)	(0.6)	(1)			
Indium				(5.1)	(1.1)			
Iodine			(5)		(3)			
Iron (Total)	2.008*		3.50*	3.38*	2.89*	(2.8*)		
Lanthanum	(17)		(23)	(34)	(40)			
Lead	11.7		18.9	5532	1162	202.1		
Lithium	(18)							
Magnesium	0.388*		1.51*	0.853*	1.05*	(0.59)		
Manganese	234.5		538	1.01*	638			
Mercury	(0.04)		1.40	32.6	6.25	3.64		(50)
Molybdenum	(1.8)		(2.0)	(19)	(1.6)	46.7		
Neodymium	(15)		(19)	(23)	(31)	N 4.78		
Nickel	22.5		88	14.3	20.6	80.2		
Phosphorus	0.027*		0.062*	0.106*	0.086*	(2.42)		
Potassium	0.864		2.03*	2.11*	2.45*	(0.49)		
Rubidium	(38)		(96)	(120)	(110)			
Samarium			(3.8)	(7.8)	(5.9)			
Scandium	(5)		(12)	(8.7)	(9)			
Selenium	0.193		1.57		1.52	16.0		
Silicon	40.00*		29.66*	28.97*	30.44*	(5.1)		
Silver			0.41	35.3	4.63	(98)		
Sodium	0.741*		1.16*	1.14*	1.14*	(0.21)		
Strontium	(68)		231	(330)	245.3			
Sulfur	0.352*		0.089*	0.240*	0.042*			
Thallium	(<0.5)		0.74	(1.3)	2.47			
Thorium	(5.8)		(11)	(13)	(14)			
Titanium	0.456*		0.342*	0.283*	0.306*	(0.32)		
Tungsten			(2)	(93)	(3)			
Uranium	(2.0)		(3)	(25)	(2.6)			
Vanadium	44.84		112	76.6	81.6			
Ytterbium			(1.6)	(1.3)	(2.7)			
Yttrium			(18)	(23)	(25)			
Zinc	48.9		106	6952	350.4	1273		
Zirconium			(160)		(230)			

Values in parentheses are not certified and are given for information only.

**These SRMs also have noncertified leach data. The leach data for SRMs 2709, 2710, and 2711 are based on EPA Method 3050; the leach data for SRM 2781 is based on EPA Methods 3050 and 3051.

112. Ceramics and Glasses

Carbides (powder form)

SRM	Type	Unit Size (in g)	Composition (mass fraction, in %)							
			SiC	Total C	Free C	Fe	O	N	Al	Ca
112b	Silicon Carbide	80	97.37	29.43	0.26	0.13			0.44	0.04
276b	Tungsten Carbide	75		6.10	(0.04)		(0.08)	(0.01)		

Values in parentheses are not certified and are given for information only.

112. Cemented Carbides (powder form)

SRMs 887–889 are prepared from sintered tungsten carbide base materials.

SRM	887	888	889
Type	Cemented Carbide (W83-Co10)	Cemented Carbide (W64-Co25-Ta5)	Cemented Carbide (W75-Co9-Ta5-Ti4)
Unit Size (in g)	100	100	100
Element	(mass fraction, in %)		
Cobalt	10.35	24.7	9.50
Tantalum		4.77	4.60
Titanium			4.03
Carbon	(5.5)	(4.6)	(6.0)

Values in parentheses are not certified and are given for information only.

112. Glasses (powder and solid forms)

SRM	81a	89	92	93a	165a	620	621	1411	1412	1413	1830	1831	1834
Type	Glass Sand	Lead-Barium	Low-Boron Soda-Lime Powder	High-Boron Borosilicate	Glass Sand (low Iron)	Soda-Lime, Flat	Soda-Lime, Container	Soft Borosilicate	Multi Component	Glass Sand (high alumina)	Soda-Lime, Float	Soda-Lime, Sheet	Fused Ore Glass
Unit Size	75 g	45 g	45 g	wafer 32 mm D×6 mm	75 g	3 platelets 35×35×3 mm	3 disks 38 mm D×5 mm	10 platelets 32×32×3 mm	8 platelets 32×32×3 mm	75 g	3 platelets 38×38×6 mm	3 platelets N37×37×3 mm	disk 30 mm D×3 mm
Component	(Concentrations are mass fractions, in %, unless noted by an asterisk for mg/kg).												
SiO_2		65.35	(75.0)	80.8		72.08	71.13	58.04	42.38	82.77	73.07	73.08	**Si 20.19**
PbO		17.50							4.40				
Al_2O_3	0.66	0.18		2.28	0.059	1.80	2.76	5.68	7.52	9.90	0.12	1.21	**Al 20.71**
FeO				0.016							0.032	0.025	
Fe_2O_3	0.082	0.049		0.028	0.012	0.043	0.040	0.050	(0.031)	0.24	0.121	0.087	**Fe 0.32**
ZnO			(0.2)					3.85	4.48				
CdO									4.38				
MnO		0.088											
TiO_2	0.12	0.01		0.014	0.011	0.018	0.014	0.02			0.011	0.019	**Ti 1.11**
ZrO_2	0.034	0.005		0.042	0.006		0.007						**Zr (0.047)**
CaO		0.21	(8.3)	0.01		7.11	10.71	2.18	4.53	0.74	8.56	8.20	**Ca 0.095**
BaO		1.40					0.12	5.00	4.67	0.12			**Ba 0.062**
Li_2O									(4.50)				**Li (4.6)**
MgO		0.03	(0.1)	0.005		3.69	0.27	0.33	(4.69)	0.06	3.90	3.51	**Mg 0.088**
K_2O		8.40	(0.6)	0.014		0.41	2.01	2.97	4.14	3.94	0.04	0.33	**K 0.42**
Na_2O		5.70	(13.1)	3.98		14.39	12.74	10.14	4.69	1.75	13.75	13.32	**Na (0.14)**
B_2O_3			0.70	12.56				10.94	4.53				**B (1.1)**
P_2O_5		0.23											**P 0.152**
As_2O_5		0.36											
As_2O_3		0.03				0.056	0.030						
SO_3		0.03				0.28	0.13				0.26	0.25	
Cl		0.05		0.060									
Cr													(0.02)
SrO								0.09	4.55				**Sr 0.153**
F													
Cr_2O_3	46*				(1*)								
Loss on Ignition		0.32	(0.42)										

Values in parentheses are not certified and are given for information only.

112. Trace Elements (powder and wafer forms)

These SRMs are for calibrating instruments and evaluating analytical techniques used to determine trace elements in inorganic matrices. **NOTE:** The nominal glass composition of SRMs 610 through 617 is 72% SiO_2, 12% CaO, 14% Na_2O, and 2% Al_2O_3.

SRM	607	610 and 611	612 and 613	614 and 615	616 and 617
Type	Trace Elements in Potassium Feldspar	Trace Elements in Glass	Trace Elements in Glass	Trace Elements in Glass	Trace Elements in Glass
Wafer Thickness (in mm)		3 and 1	3 and 1	3 and 1	3 and 1
Unit Size	5 g	6 wafers	6 wafers	6 wafers	6 wafers
Element (in mg/kg)					
Antimony				(1.06)	(0.078)
Barium			(41)		
Boron		(351)	(32)	(1.30)	(0.20)
Cadmium				(0.55)	
Cerium			(39)		
Cobalt		(390)	(35.5)	(0.73)	
Copper		(444)	(37.7)	1.37	(0.80)
Dysprosium			(35)		
Erbium			(39)		
Europium			(36)	(0.99)	
Gadolinium			(39)		
Gallium				(1.3)	(0.23)
Gold		(25)	(5)	(0.5)	(0.18)
Iron		458	51	(13.3)	(11)
Lanthanum			(36)	(0.83)	(0.034)
Lead		426	38.57	2.32	1.85
Manganese		485	(39.6)		
Neodymium			(36)		
Nickel		458.7	38.8	(0.95)	
Potassium		(461)	(64)	30	29
Rubidium	523.90	425.7	31.4	0.855	(0.100)
Samarium			(39)		
Scandium				(0.59)	(0.026)
Silver		(254)	22.0	0.42	
Strontium	65.485*	515.5	78.4	45.8	41.72
Thallium		(61.8)	(15.7)	(0.269)	(0.0082)
Thorium		457.2	37.79	0.748	0.0252
Titanium		(437)	(50.1)	(3.1)	(2.5)
Uranium		461.5	37.38	0.823	0.0721
Ytterbium			(42)		
Zinc		(433)			

Values in parentheses are not certified and are given for information only.

In addition to the elements listed above, the glass SRMs contain the following 25 elements: As, Be, Bi, Cs, Cl, F, Ge, Hf, Hg, Li, Lu, Mg, Nb, P, Pr, Se, S, Te, Tb, Tm, Sn, W, V, Y, and Zr.

*Also certified for isotopic ratio – $^{87}Sr/^{86}Sr = 1.20039$.

113. Cement

Portland Cements (powder form)

These SRMs are for x-ray spectroscopic and chemical analysis of portland cements and related materials. Each unit consists of three sealed vials, each containing approximately 5 g of material. [Also see Category 301.]

SRM	1880	1881	1882	1883	1884
COLOR	BLACK	WHITE	ORANGE	SILVER	IVORY
Component (mass fraction, in %)					
CaO	63.14	58.67	37.6	27.8	64.01
SiO_2	19.82	22.25	3.40	0.35	23.19
Al_2O_3	5.03	4.16	38.6	71.2	3.31
Fe_2O_3	2.91	4.68	15.8	0.08	3.30
SO_3	3.37	3.65			1.67
MgO	2.69	2.63	1.25	0.29	2.32
K_2O	0.91	1.17	0.12	(0.01)	0.51
TiO_2	0.23	0.25	1.83	(0.01)	0.16
Na_2O	0.28	0.04	(0.06)	0.32	0.13
SrO	0.06	0.11			0.048
P_2O_5	0.29	0.09			0.12
Mn_2O_3	0.08	0.26			0.11
F	0.10	0.09			(0.03)
ZnO	0.01	0.01			(0.02)
Cr_2O_3					(<0.01)
Cl	0.02	0.01			(0)
Loss on Ignition at 1000 °C	1.38	2.01	1.58	0.42	1.17
Total	100.28	100.04			(100.05)

SRM	1885	1886	1887	1888	1889
COLOR	TURQUOISE	CRANBERRY	BROWN	PURPLE	GRAY
Component (mass fraction, in %)					
CaO	62.14	67.43	62.88	63.78	65.08
SiO_2	21.24	22.53	19.98	20.86	20.44
Al_2O_3	3.68	3.99	5.59	5.35	5.61
Fe_2O_3	4.40	0.31	2.16	3.18	2.67
SO_3	2.22	2.04	4.61	3.16	2.68
MgO	4.02	1.60	1.26	0.71	1.38
K_2O	0.83	0.16	1.27	0.56	0.32
TiO_2	0.20	0.19	0.27	0.29	0.21
Na_2O	0.38	0.02	0.10	0.14	0.11
SrO	0.037	0.11	0.07	0.07	0.20
P_2O_5	0.10	0.025	0.075	0.085	0.15
Mn_2O_3	0.12	0.013	0.072	0.025	0.24
F	(0.05)	(0.01)	(0.11)	(0.02)	(0.04)
ZnO	(0.03)	(<0.01)	(0.01)	(0.01)	(<0.01)
Cr_2O_3	(<0.01)	(<0.01)	(<0.01)	(0.01)	(0.01)
Cl	(0.02)	(0)	(0.007)	(0.015)	(0.002)
Loss on Ignition at 1000 °C	0.74	1.73	1.49	1.79	0.92
Total	(100.19)	(100.02)	(99.908)	(100.05)	(100.04)

Values in parentheses are not certified and are given for information only.

113. Portland Cement Clinkers (solid form)

These RMs are intended primarily for use in the determination of the abundance of major phases in cement clinkers, i.e., the percentages of alite (C_3S), belite (C_2S), aluminate (C_3A), and ferrite (($C_2(A,F)$). **NOTE:** In cement chemist notation, C = CaO, S = SiO_2, A = Al_2O_3 and F = Fe_2O_3.

RM	8486	8487	8488
Type	Portland Cement Clinker	Portland Cement Clinker	Portland Cement Clinker
Unit Size (in g)	3×10	3×10	3×10
Component	(mass fraction, in %)		
CaO	(63.36)	(67.20)	(66.50)
SiO_2	(22.48)	(21.43)	(22.68)
Al_2O_3	(4.70)	(5.53)	(4.90)
Fe_2O_3	(3.60)	(1.98)	(4.07)
SO_3	(0.27)	(0.83)	(0.31)
MgO	(4.73)	(1.48)	(0.98)
K_2O	(0.42)	(0.72)	(0.35)
TiO_2	(0.25)	(0.27)	(0.24)
Na_2O	(0.10)	(0.14)	(0.11)
SrO	(0.05)	(0.11)	(0.13)
P_2O_5	(0.06)	(0.29)	(0.08)
Mn_2O_3	(0.10)	(0.04)	(0.03)
Loss on Ignition	(0.16)	(0.17)	(0.21)
Total	(100.28)	(100.20)	(100.60)
Alite (C_3S)	(58.47)	(73.39)	(64.97)
Belite (C_2S)	(23.18)	(7.75)	(18.51)
Aluminate (C_3A)	(1.15)	(12.09)	(4.34)
Ferrite ($C_2(A,F)$)	(13.68)	(3.27)	(12.12)
Free CaO	(0.18)	(2.45)	(0.00)
Periclase	(3.21)	(0.09)	(0.05)
Alkali Sulfate	(0.14)	(0.98)	(0.03)
Total	(100.01)	(100.02)	(100.02)

Values in parentheses are not certified and are given for information only.

114. Engine Wear Materials

114. Metallo-Organic Compounds (solid form)

These SRMs are for preparing solutions in oils of known and reproducible concentrations of metals. Each SRM unit consists of 5 g of material.

SRM	Type	Elemental Composition (mass fraction, in %)	
1051b	Barium cyclohexanebutyrate	Barium	28.7
1052b	Bis(1–phenyl–1,3-butanediono)oxovanadium (IV)	Vanadium	13.01
1053a	Cadmium cyclohexanebutyrate	Cadmium	24.8
1057b	Dibutyltin bis (2–ethylhexanoate)	Tin	22.95
1059c	Lead cyclohexanebutyrate	Lead	37.5
1060a	Lithium cyclohexanebutyrate	Lithium	4.1
1065b	Nickel cyclohexanebutyrate	Nickel	13.89
1066a	Octaphenylcyclotetrasiloxane	Silicon	14.14
1069b	Sodium cyclohexanebutyrate	Sodium	12.0
1070a	Strontium cyclohexanebutyrate	Strontium	20.7
1071b	Triphenyl phosphate	Phosphorus	9.48
1073b	Zinc cyclohexanebutyrate	Zinc	16.66
1075a	Aluminum 2–ethylhexanoate	Aluminum	8.07
1077a	Silver 2–ethylhexanoate	Silver	42.60
1078b	Tris (1–phenyl–1,3–butanediono)chromium (III)	Chromium	9.6
1079b	Tris (1-phenyl-1,3-butanediono)iron (III)	Iron	10.45
1080a	Bis(1–phenyl–1,3–butanediono)copper (II)	Copper	16.37

114. Lubricating Base Oils (liquid form)

These SRMs are for determining the concentrations of a single element in lubricating base oil. SRMs 1818a and 1819a consist of five bottles, approximately 20 g of liquid each; SRM 1836 consists of four sets of four ampules, each ampule containing approximately 4 g of liquid.

SRM	Type	Elemental Composition (in mg/kg)				
		I	II	III	IV	V
1818a	Total Chlorine	31.6	60.0	78.2	154.4	234.0
1819a	Total Sulfur	423.5	741.1	4022	4689	6135
1836	Total Nitrogen	9.0	50.9	113.3	166.2	

114. Catalyst Characterization Material (liquid form)

This RM is for determining the activity of FCC Catalysts by Microactivity Test. It is distributed by NIST in cooperation with the ASTM.

RM	Type	Unit Size
8590	High Sulfur Gas Oil Feed	946 mL

114. Catalyst Package for Lubricant Oxidation (liquid form)

These SRMs and RM are for evaluating the oxidation stability of lubricating oils, i.e., automotive crankcase lubricants. SRM 1817c consists of a set of five ampules of each of three materials. The fuel fraction and the metal mixture are sealed under inert atmosphere. SRM 2567 consists of a set of five ampules of each of five materials. RM 8501 consists of a set of five ampules of each of four materials. The fuel fraction, model compound, and metal mixture in SRM 2567 and RM 8501 are also sealed under inert atmosphere.

SRM	Type	Consisting of	Unit Size
1817c	Catalyst Package IIID	1) an Oxidized/Nitrated Fuel Fraction, 2) a Metal Naphthenate Mixture, and 3) Distilled Water	5×0.15 g 5×0.3 g 5×1.0 g
2567	Catalyst Package IIIE	1) an Oxidized/Nitrated Fuel Fraction, 2) a Nitro-Paraffin Model Compound, 3) a Nitro-Aromatic Model Compound, 4) a Metal Naphthenate Mixture, and 5) Distilled Water	5×0.15 g 5×0.008 g 5×0.0075 g 5×0.16 g 5×0.03 g
RM 8501	Catalyst Package IIIE	1) an Oxidized/Nitrated Fuel Fraction, 2) a Nitro-Paraffin Model Compound, 3) a Metal Naphthenate Mixture, and 4) Distilled Water	5×0.15 g 5×0.15 g 5×0.3 g 5×1.0 g

114. Wear-Metals in Oil (liquid form)

SRM	Type	Unit Size	Elemental Composition (in mg/kg)					
			Al	Cl	Cr	Cu	Fe	Pb
1083	Wear-Metals (base oil)	150 mL	(<0.5)	(<0.17)	(<0.02)	(<0.5)	(<1)	(<0.04)
1084a	Wear-Metals	Set of 5 ampules: 1.6 g each	(104)		98.3	100.0	98.9	101.1
1085a	Wear-Metals	Set of 5 ampules: 1.6 g each	(289)		296.3	295.1	296.8	297.4

SRM	Mg	Mn	Mo	Ni	Si	Ag
1083	(<0.1)	(<0.005)	(<0.01)	(<0.4)	(<1)	(<0.05)
1084a	99.5		100.3	99.7	(103)	101.4
1085a	296.0		302.9	302.9	(322)	305.7

SRM	Na	Sn	S	Ti	V	Zn
1083	(<0.06)	(<0.4)	(980)	(<5)	(<0.3)	(<0.08)
1084a		97.2	(1700)	100.4	95.9	
1085a		296.0	(4500)	305.1	292.4	

Values in parentheses are not certified and are given for information only.

Physical Properties

Standard Reference Materials

for

Physical Properties

201. Ion Activity

pH Calibration (powder form)

These SRMs are used to prepare solutions of known hydrogen ion activity to calibrate commercial pH instruments. SRMs 186If and 186IIf, 191b and 192b are each certified for use as an admixture only. SRMs 186If and 186IIf may be used to prepare solutions with a pH of 6.860 at 25 °C, or physiological buffer solutions with a pH of 7.414 at 25 °C.

SRM	Type	pH(S) Values (at 25 °C)	Unit Size (in g)
185g	Potassium Hydrogen Phthalate	4.006	60
186If	Potassium Dihydrogen Phosphate	(see above)	30
186IIf	Disodium Hydrogen Phosphate		30
187d	Sodium Tetraborate Decahydrate (Borax)		In Prep
188	Potassium Hydrogen Tartrate	3.557	60
189a	Potassium Tetroxalate	1.681	65
191b	Sodium Bicarbonate		In Prep
192a	Sodium Carbonate		In Prep
2193	Calcium Carbonate	12.46	30

201. Biological Buffer Systems (powder form)

These SRMs are used to calibrate clinical instruments (e.g., blood pH measurements), in the physiologically important range of pH 7 to 8. They are based on a biological buffer system for clinical pH measurements and are each certified for use as an admixture only. The pH(S) values for the buffer solutions are certified at 0.05 molal and 0.08 molal with respect to the free acid and the sodium salt admixture as a function of temperature. The certified temperature range is from 0 °C to 50 °C.

SRM	Type	pH(S) Values (at 37 °C)		Unit Size (in g)
		0.05 molal	0.08 molal	60
2181	HEPES Free Acid	7.364	7.373	60
2182	NaHEPESate			60
2183	MOPSO Free Acid	6.699	6.676	60
2184	NaMOPSOate			60

201. pD Calibration (powder form)

These SRMs are for the preparation of solutions of known deuterium ion activity to calibrate pH instruments to indicate pD data. SRMs 2186I and 2186II, and 2191a and 2192a are certified for use as admixtures only.

SRM	Type	pD(S) Values (at 25 °C)	Unit Size (in g)
2185	Potassium Hydrogen Phthalate	4.518	60
2186I	Potassium Dihydrogen Phosphate	7.428	30
2186II	Disodium Hydrogen Phosphate		30
2191a	Sodium Bicarbonate	10.732	30
2192a	Sodium Carbonate		30

201. Ion-Selective Electrode Calibration (powder form)

These SRMs are certified for the calibration of ion-selective electrodes and have conventional ionic activities based on the Stokes-Robinson hydration theory for ionic strengths greater than 0.1 mol/L.

SRM	Type	Certified Component	Unit Size (in g)
2201	Sodium Chloride	pNa, pCl	125
2202	Potassium Chloride	pK, pCl	160
2203	Potassium Fluoride	pF	125

201. Electrolytic Conductivity (liquid form)

These SRMs are for calibrating and standardizing conductivity cells and meters used in water purity determinations and in clinical applications. SRM 3190 is an aqueous solution of hydrochloric acid; SRMs 3191 through 3195 are solutions of high purity potassium chloride in deionized water in equilibrium with atmospheric carbon dioxide. SRM 3196 is a solution of high purity sodium chloride in deionized water in equilibrium with atmospheric carbon dioxide. (NOTE—This SRM closely matches biological fluids for conductivity measurements in clinical materials. SRMs 3190–3195 are less suitable for such purposes.) SRMs 3198 and 3199 are solutions of potassium chloride in a mixture of n-propanol and deionized water.

SRM	Type	Nominal Conductivity (μS/cm)	Unit Size (in mL)
3190	HCl in deionized Water	25	500
3191	KCl in deionized Water	100	500
3192	KCl in deionized Water	500	500
3193	KCl in deionized Water	1000	500
3194	KCl in deionized Water	10000	500
3195	KCl in deionized Water	100000	500
3196	NaCl in deionized Water	20000	500
3198	KCl in n-propanol/deionized Water	5	500
3199	KCl in n-propanol/deionized Water	15	500

202. Polymeric Properties

Molecular Weight and Melt Flow (liquid, pellet and powder forms)

These SRMs are for the calibration of instrumentation used in polymer technology science for the determination of molecular weight and molecular weight distribution and as characterized samples for other physical properties of polymers.

SRM	Type	Unit Size (in g)
705a	Polystyrene, narrow molecular weight distribution, $M_w \approx 179{,}300$, $M_w/M_n \approx 1.07$	5
706	Polystyrene, broad molecular weight distribution, $M_w \approx 257{,}800$, $M_w/M_n \approx 2.1$	18
1473a	Polyethylene Resin, low density, melt flow = 1.17 g/10 min	60
1474	Polyethylene Resin, melt flow = 5.03 g/10 min	60
1475a	Polyethylene, linear, $M_w \approx 52{,}000$ ($M_z:M_w:M_n \approx 7.54:2.90:1$), melt flow = 2.02 g/10 min	50
1478	Polystyrene, narrow molecular weight distribution, $M_w \approx 37{,}400$ ($M_w/M_n \approx 1.04$)	2
1479	Polystyrene, narrow molecular weight distribution, $M_w \approx 1{,}050{,}000$	2
1480	Polyurethane ($M_w \approx 47{,}300$)	1
1482a	Polyethylene, linear, $M_w \approx 13{,}600$ ($M_w/M_n \approx 1.19$)	1
1483	Polyethylene, linear, $M_w \approx 32{,}100$ ($M_w/M_n \approx 1.11$)	1
1484a	Polyethylene, linear, $M_w \approx 119{,}600$ ($M_w/M_n \approx 1.19$)	0.3
1487	Poly(methylmethacrylate), $M_w \approx 6{,}000$	2
1488	Poly(methylmethacrylate), $M_n \approx 29{,}000$	2
1489	Poly(methylmethacrylate), $M_n \approx 115{,}000$	2
1496	Polyethylene Gas Pipe Resin, melt flow (Unpigmented)	908
1497	Polyethylene Gas Pipe Resin, melt flow (Pigmented)	9080
1923	Poly(ethylene oxide), $M_w \approx 26{,}900$ ($M_w/M_n \approx 1.04$)	0.2
1924	Poly(ethylene oxide), $M_w \approx 120{,}900$ ($M_w/M_n \approx 1.06$)	0.2

Property	Method	705a	706	1473a	1474	1475a	1478	1479	1480	1482a	1483	1484a	1487	1488	1489	1496	1497	1923	1924
Molecular Weight:																			
Weight Average	(Light Scattering)	X	X			X		X	X	X	X	X						X	X
	(Sed. Equili.)	X	X				X						X	X					
	(Gel Permeation/Filtration Chromatography-GPC)																	X	X
Number Average	(Osmometry)	X					X			X	X	X			X				
	(Size Excl. Chromatography)					X			X										
MolecularWeight Distribution	(GPC)					X													
Limiting Viscosity No.	(Capillary Viscometry)																		
Benzene, 25 °C		X	X																
Benzene, 35 °C		X																	
Cyclohexane, 35 °C		X	X																
1–Chloronaphthalene, 130 °C						X				X	X	X							
1,2,4–Trichlorobenzene, 130 °C						X				X	X	X							
Decahydronaphthalene, 130 °C						X													
Tetrahydrofuran, 25 °C									X				X						
Toluene, 25 °C							X							X	X				
Melt Flow	(ASTM)			X	X	X										X	X		
Density	(ASTM)					X													
Heat Capacity	(Adiabatic)	X				X													

202. Polyethylene Pipe Products

These RMs are for the testing and characterization of polyethylene pipe products.

RM	Type	Tensile Properties* (in MPa)	Melt Flow (in g/10 min)	Density (in g/cm^3)
8450	Polyethylene Piping, 1.3 cm	16.40/0.125	0.851	0.938
8451	Polyethylene Piping, 4.8 cm	17.35/0.127		0.937
8452	Polyethylene Piping, 10.2 cm			0.938
8453	Polyethylene Socket T Joint		0.508	
8454	Polyethylene Butt T Joint		0.996	

*Expressed as Yield Stress/Strain at Yield (Strain Rate=81% per min).

203. Thermodynamic Properties

Combustion Calorimetry (powder form)

These SRMs are for use as standards for calibration of combustion bomb calorimeters used in checking the performance of apparatus and analytical procedures and for the characterization of high purity compounds, fuels, and related fuel materials.

SRM	Type	Heat of Combustion (in MJ/kg)*	Unit Size (in g)
39j	Benzoic Acid	26.434	30
1656	Thianthrene	33.480	30
1657	Synthetic Refuse-Derived Fuel	13.87**	100
2151	Nicotinic Acid	22.184	25
2152	Urea	10.536	25
2683a	Coal, Bituminous: %S=1.89; %Ash=6.8	31.90**	50
2684a	Coal, Bituminous: %S=3.06; %Ash=11.0	28.50**	50
2692a	Coal, Bituminous: %S=1.184; %Ash=7.94	32.64**	50

*The calorific values (MJ/kg) may decrease upon the aging or normal oxidation of the coals. NIST will continue to monitor these calorific values and report any substantive change to the purchaser.
**Gross calorific value or HHV (Higher Heating Value).

203. Solution Calorimetry

SRM	Type	Heat of Solution (in MJ/kg)	Unit Size (in g)
1655	Potassium Chloride (Water Solution Calorimetry)	Absorbed (0.235)	30

203. Flash Point Reference Materials (liquid form)

These RMs are for verifying the performance of various flash point testing instruments. The reference flash points of RMs 8517, 8518, 8519, and 8520 for specific flash point methods were determined through a cooperative interlaboratory program between NIST and ASTM S-15 Coordinating Committee on Flash Point. The participating laboratories used ASTM Standard Test Methods D 56, D 92, D 93, D 3278, and D 3828. Each RM unit contains 4×20 mL of liquid.

RM	Type	ASTM Test Method	Reference Value (in °C)	Unit Size
8517	n-Decane	D 56	50.9	Set of 4 ampules
		D 93	52.8	
		D 3278/D 3828	49.7	
8518	n-Undecane	D 56	67.1	Set of 4 ampules
		D 92	73.2	
		D 93	68.7	
		D 3278/D 3828	65.9	
8519	n-Tetradecane	D 92	115.5	Set of 4 ampules
		D 93	109.3	
8520	n-Hexadecane	D 92	138.8	Set of 4 ampules
		D 93	133.9	

203. Enthalpy and Heat Capacity (solid forms)

SRM	Type	Unit Size	Temperature Range (in K)	Molecular Weight (in g/mol)
RM 5	Copper	0.19 D×12 cm	25 to 300	
705a	Polystyrene	5 g	10 to 350	170,900
720	Synthetic Sapphire	15 g	10 to 2250	
781-D2	Molybdenum	0.64 D×10 cm	273.15 to 2800	

203. Differential Scanning Calorimetry (solid forms)

These SRMs are for calibrating differential scanning calorimeters, differential thermal analyzers, and similar instruments. SRM 1514 is for evaluating methods of determining purity by differential scanning calorimetry. It consists of pure phenacetin and phenacetin doped with p-aminobenzoic acid.

SRM	Type	Unit Size	Melting Temperature (in K)	Enthalpy of Fusion (in J/g)
1514	Thermal Analysis Purity Set	Set of 4 vials: 0.5 g each		*
2220	Tin (99.9995%)	2.5 cm×2.5 cm×0.0127 cm	505.10	60.22
2221b	Zinc (99.999%)		In Prep	
2222	Biphenyl (99.984%)	1 g	342.41	120.41
2225	Mercury	2.5 g	234.30	11.469

*Certified for four levels of p–ABA (in mol %).

203. Differential Thermal Analysis (liquid and solid forms)

In cooperation with the International Confederation of Thermal Analysis and Calorimetry (ICTAC), NIST distributes transition point, melting point and magnetic transition measurement RMs 8754, 8759, and 8760 for use with differential thermal analyzers, differential scanning calorimeters, and thermogravimetry apparatus.

The ICTAC has recently undertaken a complete reevaluation of all the materials comprising these RMs and it is anticipated that the RMs will be redistributed in the future, as single material units rather than in sets. Therefore, only limited quantities of the current RMs are still available. Information about RM status can be obtained by contacting the SRM Program Sales Office.

203. Superconductive Thermometric Fixed Point Device

This SRM is composed of six small cylinders of high purity materials mounted in a threaded copper stud and enclosed in a measuring coil pair. It is intended to provide superconductive fixed points, i.e., temperature of transitions from the normal to the superconductive state.

SRM	Type	Material	Temperature (in K)
767a	Superconductive Thermometric Fixed Point Device	Niobium	9.2
		Lead	7.2
		Indium	3.4
		Aluminum	1.2
		Zinc	0.9
		Cadmium	0.5

203. Defining Fixed Point, International Temperature Scale of 1990, ITS-90 (solid forms)

These SRMs are for use in preparing defining fixed points of the International Temperature Scale of 1990, ITS-90.

SRM	Type	Temperature (in °C)	Unit Size (in g)
740a	Zinc (Freezing Point)	419.527	200, shot
741	Tin (Freezing Point)	231.928	350, ingot
743	Mercury (Triple Point)	−38.8344	680, ampule
1744	Aluminum (Freezing Point)	660.323	200, shot
1745	Indium (Freezing Point)	156.5985	20×10, ingot
1746	Silver (Freezing Point)	961.78	300, shot

203. Defining Fixed Point Cells, International Temperature Scale of 1990, ITS-90

These SRM fixed point devices are for use in the realization of the International Temperature Scale of 1990, ITS-90.

SRM	Type	Temperature (in °C)	Unit Size (in g)
1747	Tin (Freezing Point), 99.9999+%	231.928	1071, semi-open cell
1748	Zinc (Freezing Point), 99.9999+%	419.527	1031, semi-open cell

203. Reference Points (solid forms)

These moderate purity SRMs are for use in preparing reference point devices and for calibrating thermometers, thermocouples and other temperature measuring devices.

SRM	Type	Temperature (in °C)	Unit Size (in g ingot)
45d	Copper (Freezing Point)	1084.8	450
49e	Lead (Freezing Point)	327.45	600
742	Alumina, 99.9+%	2052	10 (powder)

203. Freezing Point, Melting Point, and Triple Point Cells (solid forms)

These SRM fixed point devices are for use in the realization of internationally accepted secondary reference points and/or triple points. They are **not** intended for calibration of differential scanning calorimeters.

SRM	Type	Temperature (in °C)	Unit Size (in g)
1968	Gallium (Melting Point), 99.9999+%	29.7646	25, sealed cell
1969	Rubidium (Triple Point), 99.9+%	39.3	154, sealed cell
1970	Succinonitrile (Triple Point), 99.999+%	58.0642	60, sealed cell
1971	Indium (Freezing Point), 99.9999+%	156.598	100, sealed cell
1972	1,3-Dioxolan-2-one (Ethylene Carbonate) (Triple Point), 99.999+%	36.3143	60, sealed cell
1973	n-Docosane (Triple Point), 99.999+%	43.879	60, sealed cell

203. Laboratory Thermometer (mercury in glass)

This thermometer is for use in clinical laboratories. Its main scale extends from 24.00 °C to 38.00 °C, in 0.05 °C divisions. It has an auxiliary scale from −0.20 °C to +0.20 °C.

SRM	Type	Calibrated Points (in °C)	Unit Size
934	Clinical Laboratory Thermometer	0, 25, 30, 37	1 each

203. Thermoelement Material, Platinum (wire form)

SRM	Type	Temperature Range (in °C)	Unit Size
1967	Platinum, High Purity (99.999+%)	197 to 1767	0.051D×100 cm

203. Vapor Pressure of Metals (rod and wire forms)

SRM	Type	Pressure Range (in Pa)	Temperature Range (in K, ITS-90)	Unit Size (in cm)
745	Gold	10^{-4} to 10^{2}	1300 to 2100	wire, 0.14×15.2
746	Cadmium	10^{-6} to 10^{1}	350 to 594	rod, 0.64×6.4

203. Thermal Conductivity of Graphite and Metals (rod form)

SRM	Type	Unit Size (in cm)	Temperature Range (in K)	Conductivity at 293 K (in $W \cdot m^{-1} \cdot K^{-1}$)
1461	Stainless Steel	1.27D×5.0	2 to 1200	14.1
1462	Stainless Steel	3.18D×5.0	2 to 1200	14.1
RM 8420	Electrolytic Iron	0.64D×5.0	2 to 1000	77.9
RM 8421	Electrolytic Iron	3.18D×5.0	2 to 1000	77.9
RM 8424	Graphite	0.64D×5.0	5 to 2500	90.9
RM 8425	Graphite	1.27D×5.0	5 to 2500	90.9
RM 8426	Graphite	2.54D×5.0	5 to 2500	90.9

203. Thermal Expansion of Metal Glass and Silica (rod form)

SRM	Type	Temperature Range (in K)	Unit Size (in cm)
731	Borosilicate Glass	L1: 80 to 680	0.64×5.1
		L2: 80 to 680	0.64×10.2
		L3: 80 to 680	0.64×15.2
736	Copper	L1: 20 to 800	0.64×5.1
738	Stainless Steel (AISI 446)	293 to 780	0.64×5.1
739	Fused Silica	L1: 80 to 1000	0.64×5.1
		L2: 80 to 1000	0.64×10.2
		L3: 80 to 1000	0.64×15.2

203. Thermal Resistance of Glass, Silica, and Polystyrene (solid forms)

SRM	Type	Unit Size (in cm)	Temperature Range (in K)	Thermal Resistance at 293 K (in $m^2 \cdot K \cdot W^{-1}$)
1449	Fumed Silica Board	60×60×2.54	297.1	1.2
1450c	Fibrous Glass Board	61×61×2.54	280 to 340	0.78
1452	Fibrous Glass Blanket	60×60×2.54	297.1	0.60
1453	Expanded Polystyrene Board	66×93×1.34	285 to 310	0.4
1459	Fumed Silica Board	30×30×2.54	297.1	1.2

204. Optical Properties

Molecular Absorption (film, filter, solid, and solution forms)

The optical SRMs for spectrophotometry are certified transfer standards that fall into three general categories—transmittance, wavelength, and stray radiant energy—each of which addresses a specific instrumental parameter of an absorption spectrometer that must be in control for accurate optical transmittance measurements. To obtain optimum verification results, each SRM must be used within the specified range of conditions for which it is intended.

SRM 930e: This SRM is for the verification of the transmittance and absorbance scales of visible absorption spectrometers. It differs from the prior series, SRM 930d, only with respect to tightened optical polishing tolerances. SRM 930e has been polished to a parallelism of 20 arc seconds or better, to reduce the optical deviation (relative to SRM 930d) and improve performance in instruments where wavelength dispersion occurs *after* the light has passed through the filter. SRM 930e consists of three individual Schott NG-type glass filters in separate metal cuvette-style holders and an empty filter holder. The nominal percent transmittances of the three filters are 10 %, 20 %, and 30 %. The three filters are individually certified for transmittance at five wavelengths in the visible spectrum: 440.0 nm, 465.0 nm, 546.1 nm, 590.0 nm, and 635.0 nm. The optical transmittance neutrality of SRM 930e is sufficient for the filters to be used to verify accurately absorption spectrometers with maximum spectral bandpasses ranging from 2.2 nm to 6.5 nm for the five wavelengths at which the transmittances are certified. When SRM 930e is used in combination with SRM 1930, a 6-point stepwise verification of the transmittance scale is possible over the transmittance range from 1 % to 50 %. A detailed discussion of this SRM and SRM 1930 is given in Special Publication 260–116. (See NOTE.)

SRM 931e: This SRM is for the verification of the absorbance scales of ultraviolet and visible absorption spectrometers having narrow spectral bandpasses. SRM 931e consists of three sets of four solutions in sealed 10 mL ampules. The four solutions include a blank solution and three concentrations of an empirical inorganic solution prepared from high purity cobalt and nickel metals dissolved in a mixture of nitric and perchloric acids. The user must transfer the blank and standard solutions to cuvettes of known pathlength. The spectrum has absorption maxima at 302 nm, 395 nm, and 512 nm, and a plateau in the region of 678 nm at which the absorbances are certified. The nominal absorbances of the three empirical inorganic solution standards are 0.3, 0.6 and 0.9, respectively, at wavelengths 302 nm, 395 nm, and 512 nm. At wavelength 678 nm, the nominal absorbances of the three solutions are 0.1, 0.2, and 0.3, respectively. The liquid filters may be used to verify absorption spectrometers with maximum spectral bandpasses ranging from 1.5 nm to 8.5 nm for the four wavelengths at which the absorbances are certified.

SRM 935a: This SRM is for the verification of the absorbance scales of ultraviolet absorption spectrometers having spectral bandpasses not exceeding 2 nm. Issued in 15 g units, SRM 935a consists of crystalline potassium dichromate of established purity. Solutions of ten known concentrations of this SRM in 0.001 N perchloric acid (between 20 mg/kg and 200 mg/kg) are certified for their specific absorbances under well-defined conditions. The user must prepare the liquid solutions from SRM 935a and then transfer them to cuvettes of known pathlength. The certified specific absorbances for the solutions prepared may be converted to their corresponding reference absorbance values using Beer's Law. Acidic SRM 935a solutions may be prepared anywhere within the concentration range of 20 mg/kg to 200 mg/kg to provide a standard with the desired absorbance at a specified wavelength. The spectrum has absorption maxima at 257 nm and 350 nm, and absorption minima at 235 nm and 313 nm at which the specific absorbance values are certified. A detailed discussion of this SRM is given in Special Publication 260–54.

SRM 1921: This SRM is for use in the calibration of the wavelength scale of spectrometers in the infrared (IR) spectral region from 3.2 μm to 18 μm (555 cm^{-1} to 3125 cm^{-1}). SRM 1921 consists of three cards made of a matte finish polystyrene film, approximately 38 μm thick with a 25-mm diameter clear aperture and centered 38 mm from the bottom of a cardboard holder 5 cm × 11 cm × 2 mm in size. The certified wavelength values, corresponding peak wavenumber values for thirteen absorption peak positions in the 3 μm to 18 μm range and a spectrum marked with arrows identifying the certified peaks, are provided with each unit. A detailed discussion of this SRM is given in Special Publication 260-122.

SRM 1930: This SRM complements SRM 930e for the verification of the transmittance and absorbance scales of visible absorption spectrometers. SRM 1930 consists of three individual Schott NG-type glass filters in separate metal cuvette-style holders and an empty filter holder. The nominal transmittances of the three filters are 1 %, 3 %, and 50 %. The three filters are individually certified for transmittance at five wavelengths in the visible spectrum: 440.0 nm, 465.0 nm, 546.1 nm, 590.0 nm, and 635.0 nm. The optical transmittance neutrality of SRM 1930 is sufficient for the filters to be used to verify accurately absorption spectrometers with maximum spectral bandpasses ranging from 2.2 nm to 6.5 nm for the five wavelengths at which the transmittances are certified. When SRM 1930 is used in combination with SRM 930e, a 6-point stepwise verification of the transmittance scale is possible over the transmittance range from 1 % to 50 %. A detailed discussion of this SRM and SRM 930 is given in Special Publication 260–116. (See NOTE.)

SRM 2030a: This SRM is for use in the one-point verification of the transmittance and absorbance scales of spectrophotometers at the given wavelength and at the nominal transmittance of 30 %. SRM 2030a consists of one glass filter in its holder and one empty holder. The exposed surface of the glass is approximately 29 mm×8 mm, measured from a point 1.5 mm above the base of the filter holder. The filter bears an identification number. The certified transmittance value at a wavelength of 465.0 nm and for a maximum spectral bandpass of 2.7 nm is provided for each unit. The uncertainty estimation is described in Special Publication 260-116. (See NOTE.)

SRM 2031a: This SRM is for the verification of the transmittance and absorbance scales of ultraviolet and visible absorption spectrometers. SRM 2031 consists of three individual non-fluorescent, fused silica filters in separate metal cuvette-style holders and an empty filter holder. The nominal transmittances of the three filters are 10 %, 30 %, and 90 %. The quartz base plates of the 10 % and 30 % filters carry different thicknesses of semi-transparent chromium metal that are optically contacted to quartz cover plates. The nominal 90 % filter is a single clear quartz plate. The three filters are individually certified for transmittances at ten wavelengths in the ultraviolet and visible spectral regions: 250.0 nm, 280.0 nm, 340 nm, 360.0 nm, 400.0 nm, 465.0 nm, 500.0 nm, 546.1 nm, 590.0 nm, and 635.0 nm. The optical transmittance neutrality of SRM 2031 is such that wider spectral bandpasses can be used. Consequently, SRM 2031 is the only transmittance SRM that is suitable for use with those absorption spectrometers with large spectral bandpasses, e.g., 8 nm to 20 nm. A detailed discussion of this SRM is given in Special Publication 260-68. CAUTION: Because the 10 % and 30 % chromium-coated filters attenuate incident radiation by reflection to a large extent, SRM 2031a may possibly generate interreflections between optical surfaces in the sample compartment of some absorption spectrometers. Such interreflections may affect the accuracy of the transmittance measurement. Consequently, when contemplating the purchase of SRM 2031a, the user should contact the instrument manufacturer to verify that metal-on-quartz filters are compatible with the spectrometer.

SRM 2032: This SRM is for use in the assessment of heterochromatic stray radiation energy (stray light) in ultraviolet absorption spectrometers in the spectral region below 260 nm. Issued in 25 g units, SRM 2032 consists of reagent grade crystalline potassium iodide (KI). Solutions of this SRM in distilled water are certified for their specific absorbances under well-defined conditions at 240 nm, 245 nm, 250 nm, 255 nm, 260 nm, 265 nm, 270 nm, and 275 nm. The KI solutions exhibit sharp cutoffs in transmittances below about 260 nm. The user must prepare a liquid KI solution from SRM 2032 and then transfer it to a cuvette of known pathlength. The certified specific absorbance for the solution prepared is then converted to its corresponding reference transmittance or absorbance value using Beer's Law. The amount of heterochromatic stray light in the absorption spectrometer at a wavelength below 260 nm may be determined from the equations given in the certificate.

SRM 2034: This SRM is for use in the verification of the wavelength scale of ultraviolet and visible absorption spectrometers having nominal spectral bandwidths not exceeding 3 nm. SRM 2034, a liquid consisting of 4% (m/v) holmium oxide in an aqueous solution of 10% (v/v) perchloric acid, is sealed in a nonfluorescent, fused silica cuvette of optical quality. SRM 2034 is batch certified for wavelength location of minimum transmittance of 14 bands in the spectral range from 240 nm to 650 nm for six spectral bandwidths from 0.1 nm to 3 nm. A detailed discussion of this SRM is given in Special Publication 260–102. (See NOTE.)

NOTE: A recertification service for units of this SRM whose certification has expired, is available directly from the NIST Analytical Chemistry Division. Contact the Division for details: Phone — (301) 975-4115;
Fax — (301) 977-0587.

204. Molecular Absorption (film, filter, solid, and solution forms)—Continued

SRM	Type	Wavelength Range (in nm)	Unit Size
930e	Glass Filters, Transmittance	440 to 635	3 filters/4 holders
931e	Liquid Filters, Absorbance	302 to 678	Set of 12 ampules
935a	Potassium Dichromate, UV Absorbance	235 to 350	15 g
1921	Infrared Transmission Wavelength	3 μm to 18 μm	3 polystyrene cards
1930	Glass Filters, Transmittance	440 to 635	3 filters/4 holders
2030a	Glass Filter, Transmittance	465.0	1 filter/1 holder
2031a	Metal-on-Quartz Filters, Transmittance	250 to 635	In Prep
2032	Potassium Iodide, Stray Light	240 to 280	25 g
2034	Holmium Oxide Solution, Wavelength	240 to 650	1 sealed cuvette

204. Molecular Luminescence (solid form)

This SRM is for use in the evaluation of methods and the calibration of fluorescence spectrometers. Issued in 1 g units, SRM 936 consists of solid quinine sulfate dihydrate. It is certified for the relative molecular emission spectrum, $E(\lambda)$, in radiometric units for a solution of 1.28×10^{-6} mol/L quinine sulfate dihydrate in 0.105 mol/L perchloric acid using an excitation wavelength of 347.5 nm. The values of the molecular emission spectrum are certified at 5 nm wavelength intervals from 375 nm to 675 nm. The user must prepare the solution and transfer it to a cuvette of known pathlength. A detailed discussion of this SRM is given in Special Publication 260–64.

SRM	Type	Wavelength Range (in nm)	Unit Size
936a	Quinine Sulfate Dihydrate, Fluorescence	375 to 675	1 g

204. Specular Spectral Reflectance (plate form)

These SRMs are for calibrating the reflectance scale of integrating sphere reflectometers used to evaluate materials for solar energy collectors and to calibrate reflectometers used in evaluating the appearance of polished metals and metal-plated objects.

SRM	Type	Wavelength Range (in nm)	Unit Size (in cm)
2003	First Surface, Aluminum on Glass	250 to 2500	5.1D×0.65
2011	First Surface, Gold on Nickel-Plated Aluminum	600 to 2500	5.1D×1.2
2023	Second Surface, Aluminum on Fused Quartz	250 to 2500	5.1D×0.6
2026	First Surface, Black Glass	250 to 2500	5.1D×0.6

204. Infrared Reflectance (solid form)

This SRM is for establishing the accuracy of the near infrared (IR) wavelength scale of reflectance spectrophotometers.

SRM	Type	Wavelength Range (in nm)	Unit Size (in cm)
1920a	Rare Earth Oxide Mixture	740 to 2000	holder: 5.1D×1.2

204. Diffuse Spectral Reflectance (wafer form)

This SRM is for calibrating the photometric scale of integrating sphere reflectometer-spectrophotometers used in the measurement of spectral 6°/hemispherical reflectance.

SRM	Type	Wavelength Range (in nm)	Unit Size (in cm)
2015	White Opal Glass (vitrolite)	400 to 750	5.1×3.8

204. Optical Rotation (powder form)

These SRMs are for calibrating or checking polarimetric apparatus. In aqueous solution, the optical rotation of SRM 17d is certified at three wavelengths, while that of SRM 41c is certified at two wavelengths. SRM 41c is also certified at one wavelength in a dimethyl sulfoxide solution.

SRM	Type	Optical Rotation (in mrad)—Aqueous Solution Wavelength			Unit Size (in g)
		546 nm	589 nm	633 nm	
17d	Sucrose	711.64	604.26	519.17	60
41c	Dextrose	1101.1	931.8	798.6	70

204. X-Ray and Photography (chart and step tablet forms)

SRM 1001 is a calibrated x-ray film step tablet of 17 steps that cover the optical density range from <0.200 to >4.000; it has a blue tint and emulsion on both sides. SRM 1008 is a calibrated photographic step tablet of 21 steps that cover the optical density range from <0.200 to >4.000; it has a black tint and emulsion on a single side. SRM 1010a is used to test the resolving power of cameras or of whole microcopying systems. It consists of five charts printed photographically on paper, that have 26 high-contrast, 5-line patterns ranging in spatial frequency of 1 mm^{-1} to 18 mm^{-1}.

SRM	Type	Unit Size
1001	X-ray Film Step Tablet	25.4 cm × 3.5 cm
1008	Photographic Step Tablet	25.4 cm × 3.5 cm
1010a	Microcopy Resolution Test Chart	Set of 5 charts

205. Radioactivity

Radiation Dosimetry (wire form)

This SRM is a cobalt-in-aluminum alloy wire 0.5 mm in diameter and 1 m in length for use as a neutron density monitor standard.

SRM	Type	Cobalt Composition (mass fraction, in %)
953	Neutron density monitor wire (Co in Al)	0.116

205. Fission Track Glass (wafer form)

This SRM, which contains uranium, will aid laboratories performing fission track analyses in interlaboratory comparisons of data and in monitoring neutron fluences. The material was irradiated in the 20 MW reactor at the NIST Center for Neutron Research, at two different neutron energies. Each unit consists of four unirradiated glass wafers and two irradiated wafers.

SRM	Uranium Composition (in mg/kg)	Uranium-235 (in Atom %)	Reactor Position	Neutron Fluence (10^{14} n/cm^2) Copper Foil	Gold Foil
963a	0.823	0.2792	RT-4:	39.5	43.0
			RT-3:	41.2	45.8

205. Special Nuclear Materials

The U.S. Department of Energy New Brunswick Laboratory issues special nuclear reference materials as NBL Certified Reference Materials (CRMs). These CRMs include the plutonium and uranium assay and isotopic materials previously issued by the National Institute of Standards and Technology. All orders or inquiries should be addressed to: U.S. Department of Energy, New Brunswick Laboratory, 9800 S. Cass Avenue, Bldg. 350, Argonne, IL 60439-4899. Attn: Reference Materials Sales; Phone – (630) 252-2767; Fax – (630) 252-6256; E-mail – usdoe.nbl@ch.doe.gov.

The SRMs in the following 4 pages are certified and distributed for the SRM Program by the NIST Radioactivity Group. The radionuclide types represented by these SRMs are suitable for a variety of measurement and instrument calibration needs. Detailed information about the NIST Radioactivity SRMs and a form for license certification can be obtained by contacting the Radioactivity Group. Inquiries should be directed to the **National Institute of Standards and Technology, Radioactivity Group, Ionizing Radiation Division, Building 245, Room C114, Gaithersburg, MD 20899-0001; Phone — (301) 975-5531; Fax — (301) 926-7416; E-Mail — rad.srms@nist.gov.**

Requests for new or renewal SRMs can be submitted to the Radioactivity Group. Upon receipt, these requests are evaluated and interested customers are notified whether or not the SRMs can be made available.

NOTE: Certain radionuclides are not economical to maintain as SRMs because of short half lives or low customer demand. NIST Special Publication 250, *Calibration Services Users Guide*, describes the procedure for requesting calibration of radionuclides not provided as SRMs. Requests for such tests should also be submitted, with full source information for approval of suitability, to the Radioactivity Group at the above address.

205. Radioactive Solutions

These SRMs are intended for the calibration of radioactivity measuring instruments and for the monitoring of chemical and geochemical processes. They are calibrated in terms of activity per gram of solution. Each SRM is contained in a flame-sealed glass ampule or bottle and, except as noted, consists of the radionuclide dissolved in an aqueous solution (usually acidic).

SRM	Radionuclide	Decay Modes	Activity per gram (in Bq • g^{-1})	Time of Calibration (month/year)	Volume of Solution (mL)
4322B*	Americium-241	α	40	09/91	5
4332D*	Americium-243	α	40	05/95	5
4251C*	Barium-133	EC, γ	500 000	09/93	5
4222C	Carbon-14 (as hexadene)	β^-	50 000	09/90	5
4233D*	Cesium-137 Burn-up Standard	β^-, γ	600 000	07/95	5
4943	Chlorine-36	β^-	10 000	12/84	3
4915E*	Cobalt-60	β^-, γ	75 000	01/95	5
4329*	Curium-243	α	70	06/84	5
4320A*	Curium-244	α	35	02/96	5
4370C*	Europium-152	β^-, EC, γ	90 000	02/87	5
4361C	Hydrogen-3 (as water)	β^-	1	In Prep	490
4926D	Hydrogen-3 (as water)	β^-	3 000	07/89	18
4927E	Hydrogen-3 (as water)	β^-	500 000	07/91	3
4947C	Hydrogen-3 (as toluene)	β^-	300 000	03/87	4
4949C*	Iodine-129	β^-, γ	3 000	03/93	5
4929E	Iron-55	EC	30 000	In Prep	5
4341*	Neptunium-237	α	100	03/94	5
4226C*	Nickel-63	β^-	50 000	08/95	5
4323A*	Plutonium-238	α	30	02/94	5
4330A*	Plutonium-239	α	40	12/95	5
4338A*	Plutonium-240	α	40	05/96	5
4340A*	Plutonium-241	β^-	250	12/95	5
4334F*	Plutonium-242	α	25	12/89	5
4326	Polonium-209	α, EC	90	03/94	5
4952C	Radium-226 Blank	–	0.000 2	08/91	5
4965	Radium-226	α, γ	30	09/91	5
4966	Radium-226	α, γ	270	09/91	5
4967	Radium-226	α, γ	2 700	09/91	5
4339A	Radium-228	β^-	200	04/94	5
4919H*	Strontium-90	β^-	4 000	07/95	5
4234A*	Strontium-90	β^-	2 500 000	03/95	5
4288A	Technetium-99	β^-	30 000	09/96	5
4328B	Thorium-229	α	30	07/96	5
4324A	Uranium-232	α	40	11/93	5
4321B	Uranium-238 "natural uranium"	α	250	01/92	5
4276C*	Long-Lived Mixed Radionuclide:			09/88	5
	Antimony-125	β^-, γ	12 000		
	Europium-154	β^-, γ	16 000		
	Europium-155	β^-, γ	6 000		

* License certification is required of purchaser by NIST before shipment.

205. Radiopharmaceuticals (solution and gaseous forms)

These SRMs are intended for the calibration of radioactivity-measuring instruments. They are calibrated in terms of activity per gram of solution (except SRM 4415, which is calibrated in terms of activity). Each SRM is contained in a 5 mL flame-sealed glass ampule and, except for SRM 4415, consists of the radionuclide dissolved in an aqueous solution (usually acidic).

These SRMs are produced in collaboration with the Nuclear Energy Institute and, because of the short half lives, are available only at specific times. For the current production schedule, contact the Radioactivity Group at the address given on page 112.

SRM	Radionuclide	Half Life (days)	Activity per gram ($MBq \cdot g^{-1}$)
4408F*	Cobalt-57	271.7	2
4416Q*	Gallium-67	3.3	4
4417Q*	Indium-111	2.8	5
4407U*	Iodine-125	59.6	1
4401W*	Iodine-131	8.0	5
4412V*	Molybdenum-99/Technetium-99m	2.7	10
4406O*	Phosphorus-32	14.3	2
4425B*	Samarium-153	1.9	4
4426A*	Strontium-89	50.0	1
4410V*	Technetium-99m	0.3	1 000
4404S*	Thallium-201	3.0	4
4415U*	Xenon-133	5.2	Total 500
4427B*	Yttrium-90	2.7	1

* License certification is required of purchaser by NIST before shipment.

205. Alpha Particle Point Sources

These SRMs are intended for the calibration of alpha particle detectors. Each SRM consists of a practically weightless deposit of the radionuclide electroplated on a thin platinum foil cemented to a monel disk.

SRM	Radionuclide	Principal Alpha Energies (MeV)	Activity (Bq)	Time of Calibration (month/year)
4906C*	Plutonium-238	5.456, 5.499	10 to 300	09/87
4906HC*	Plutonium-238	5.456, 5.499	1 000 to 50 000	10/87

* License certification is required of purchaser by NIST before shipment.

205. Carbon-14 Dating (solid form)

This SRM is an international standard for contemporary carbon-14 against which world-wide measurements can be compared. Each SRM consists of approximately 225 g of a 450 kg lot of oxalic acid prepared by fermentation of French beet molasses from the 1977 spring, summer, and autumn harvests.

SRM	Material	Description
4990C	Oxalic Acid	Set of 8: 28 g each

205. Accelerator Mass Spectrometry (solution form)

This SRM is intended for the calibration of accelerator mass spectrometers used to measure beryllium isotopic ratios. It is calibrated in terms of the isotopic ratio. The SRM is contained in a flame-sealed glass ampule and consists of the nuclides dissolved in an aqueous solution (acidic).

SRM	Nuclides	Isotopic Ratio	Total Nuclide Concentration ($mg \cdot g^{-1}$)	Time of Calibration (month/year)	Volume of Solution (mL)
4325	Beryllium-10/Beryllium-9	3×10^{-11}	5	08/86	50

205. Gamma Ray Point Sources

These SRMs are intended for the calibration of gamma ray detectors. Each SRM consists of a small deposit of radioactive material sealed between two layers of polyester tape that are mounted on an aluminum annulus.

SRM	Radionuclide	Principal Photon Energies (keV)	Activity (Bq)	Time of Calibration (month/year)
4241C*	Barium-133	81 to 384	In Prep	
4200B	Cesium-137/Barium-137m	662	60 000	09/79
4207B	Cesium-137/Barium-137m	662	300 000	03/87
4203D*	Cobalt-60	1173, 1332	10 000 to 60 000	01/95
4201B*	Niobium-94	702, 871	4 000	04/70
4275C*	Long-Lived Mixed Radionuclide:	27 to 1596		09/88
	Antimony-125		120 000	
	Europium-154		160 000	
	Europium-155		55 000	

*License certification is required of purchaser by NIST before shipment.

205. Radon Emanation (encapsulated solution form)

This SRM is intended for the calibration of radon-222 measuring instruments. It consists of a small heat-sealed polyethylene cylinder containing approximately 0.35 g of radium-226 solution. The SRM is calibrated in terms of the radium-226 activity and in terms of the emanation fraction of the radon-222 under specified conditions.

SRM	Radionuclide	Activity (Bq)	Time of Calibration (month/year)
4968	Radium-226	3 to 500	09/91

205. Natural Matrix Materials (powder form)

SRM 4350B—Columbia River Sediment
This material, provided in 85 g units, was collected from a river downstream from a nuclear reactor facility. Concentrations of fission and activation products are elevated over typical world-wide levels. Plutonium-239/plutonium-240 and americum-241 are very homogeneously distributed through the sample and are in acid-leachable forms. Inhomogeneity is 3% or better for other radionuclides.

SRM 4351—Human Lung
This material, provided in 45 g units, contains radioactivity concentrations on the order of 10^{-4} Bq · g^{-1}. It has been freeze-dried, cryogenically ground, homogenized, and packed in a glass bottle under vacuum. There is significant inhomogeneity in plutonium-239/plutonium-240 which is unavoidable because plutonium was taken into the lungs in particulate form. Assessments of accuracy of measurement techniques can be improved by averaging over several samples.

SRM 4352—Human Liver
This material, provided in 45 g units, contains radioactivity concentrations on the order of 10^{-4} Bq · g^{-1}. It has been freeze-dried, cryogenically ground, homogenized, and packed in a glass bottle under vacuum.

SRM 4353A—Rocky Flats Soil Number II In Prep
This material was collected at Rocky Flats, CO, but in a different location from its predecessor, SRM 4353. Transactinide concentrations are about an order of magnitude higher than typical world-wide levels and there is a potential that ≈10% of these nuclides could be in refractory form. It is also possible that ≈15% of the uranium and thorium nuclides present are in non-acid leachable form. The SRM is intended for use in validation of radiochemical environmental studies methods.

SRM 4354—Freshwater Lake Sediment
This material (gyttja) contains approximately 25 g of freeze-dried, pulverized freshwater lake sediment (approximately 50% organic by mass) in a polyethylene bottle. The SRM is intended for use in tests of measurements of environmental radioactivity contained in matrices similar to the sample, for evaluating analytical methods, or as a generally available calibrated ''real'' sample matrix in interlaboratory comparisons.

SRM 4355—Peruvian Soil
This material, provided in 75 g units, has nonmeasurable radioactivity concentrations for many fallout radionuclides and can be used as a blank or for sensitive tests of radioanalytical procedures at low radioactivity concentrations for other radionuclides. The results of a trace element study are given for 57 elements.

SRM 4356—Ashed Bone In Prep
This material, provided in 15 g units, is a partially ashed bone per sample aliquant of a 1:100 composite of human and bovine bones. The SRM is intended for use in validation of radiobiochemical methods for measurement of such radionuclides as strontium-90, radium-226, thorium-228, thorium-230, thorium-232, uranium-234, uranium-235, uranium-238, plutonium-238, plutonium-239/plutonium-240, and curium-243/curium-244. The thorium-232 and uranium-238 decay chains are **not** in equilibrium.

SRM 4357—Ocean Sediment
This material, provided in 80 g units, consists of a blend of sediments collected in the Chesapeake Bay and in the sea off of the British Nuclear Fuels Sellafield facility in the United Kingdom. The SRM, which has been freeze-dried, pulverized, homogenized, and radiation-sterilized, is intended for use in tests of low level radiochemical methods for measurement of such fission products as strontium-90 and cesium-137 and actinides such as thorium-232, uranium-238, and plutonium-239/plutonium-240.

SRM 4358—Ocean Shellfish In Prep
This material, provided in ≈300 g units, was prepared from oysters from the southeastern Pacific Ocean blended with mussels from the White and Irish Seas. The SRM is intended for use in the validation of radiochemical ocean studies methods on material which is both a food product and a bioaccumulator of radionuclides associated with ocean nuclear waste dumping programs. The radionuclides determined include strontium-90, radium-226, thorium-228, thorium-230, thorium-232, uranium-234, uranium-235, uranium-238, plutonium-238, and plutonium-239/plutonium-240.

206. Electrical Properties

Electrical Resistivity and Conductivity of Metals (rod form)

These SRM and RM materials are for evaluating methods of measuring electrical resistivity over wide temperature ranges.

SRM/RM	Type	Temperature Range (in K)	Resistivity at 293 K (in μΩ • cm)	Unit Size (in cm)
1461	Stainless Steel	5 to 1200	80.5	rod: 1.27D×5.0
1462	Stainless Steel	5 to 1200	80.5	rod: 3.18D×5.0
RM 8420	Electrolytic Iron	6 to 1000	10.1	rod: 0.64D×5.0
RM 8421	Electrolytic Iron	6 to 1000	10.1	rod: 3.18D×5.0

206. Electrical Resistivity and Conductivity of Silicon (block and wafer forms)

SRMs 2526, 2527, 2528, and 2529 are sets of 16 silicon chips, each mounted on beveling blocks, intended to provide a number of resistivity scale reference points for calibrating spreading resistance measurements of (111) p-type and n-type (SRMs 2526 and 2527) and (100) p-type and n-type (SRMs 2528 and 2529) silicon. SRMs 2541 through 2547 consist of single wafers intended for use as reference standards for sheet resistance and resistivity measurements utilizing the four-point probe method. SRMs 2541, 2542, and 2543 are made Czochralski-grown, boron-doped silicon with (100) crystallographic orientation; SRMs 2544, 2545, 2546, and 2547 are float zone (111) orientation and phosphorus-doped by the neutron transmutation doping process.

SRM	Type	Resistivity (in Ω • cm)	Unit Size (in mm)
2526	Spreading Resistance	0.001 to 200	Set of 16: 5×10×0.625
2527	Spreading Resistance	0.001 to 200	Set of 16: 5×10×0.625
2528	Spreading Resistance	0.001 to 200	Set of 16: 5×10×0.625
2529	Spreading Resistance	0.001 to 200	Set of 16: 5×10×0.625
2541	Silicon Resistivity	0.01	100D×0.625
2542	Silicon Resistivity	0.1	100D×0.625
2543	Silicon Resistivity	1	100D×0.625
2544	Silicon Resistivity	10	100D×0.625
2545	Silicon Resistivity	25	100D×0.625
2546	Silicon Resistivity	100	100D×0.625
2547	Silicon Resistivity	200	100D×0.625

206. Residual Resistivity Ratio (rod form)

This SRM is a set of five aluminum rods for use in checking four-terminal dc and eddy current decay techniques. The residual resistivity ratio (RRR), the ratio of electrical resistivity at 273.15 K to resistivity at 4 K, is a sensitive indicator of purity and of the mechanical state of a material.

SRM	Type	RRR Values	Unit Size (in cm)
769	Aluminum	130, 683, 1205, 2650, and 11,000	0.64D×5.2

206. Superconducting Critical Current (wire form)

This SRM is for checking the performance of measurement systems used in superconductor technology. It consists of 2.2 m of a multifilamentary niobium titanium, copper-stabilized superconducting wire wound in a single layer onto a spool with a core diameter of 8.7 cm.

SRM	Type	Magnetic Field (in T)	Critical Current (in A)
1457	Niobium–Titanium Wire	2.000	293.30
		4.000	187.38
		6.000	124.72
		8.000	69.72

207. Metrology

Scanning Electron Microscope (SEM)

These SRMs and RM are for calibrating the magnification scale and evaluating the performance of scanning electron microscopes. SRM 484g can be used to calibrate the magnification scale of an SEM from 1000 to 20,000 X. SRM 2069b consists of graphitized rayon fibers with smooth and uniform edges on a 12.5 mm diameter SEM specimen mount with a 3 mm peg. SRM 2090 consists of a silicon chip and was developed to meet the SEM needs of the semiconductor industry. RM 8090 is the noncertified prototype of SRM 2090.

SRM	Type	Spacings	Size in mm
484g	SEM Magnification Standard	0.5 to 5 μm	6.5D×11
2069b	SEM Performance Standard	2 to 4 mm	12D
2090	SEM Magnification Standard	0.2 to 3000 μm	10×10
RM 8090	SEM Magnification Reference	0.2 to 3000 μm	10×10

207. Optical Microscope Linewidth Measurement (photomask)

These SRMs are for use in calibrating optical microscopes used to measure the widths of opaque lines and clear spaces on integrated circuit photomasks. They can also be used to calibrate line spacings and line-to-space ratios. They are not for use with partially transmitting materials, in reflected light with opaque materials, or in a scanning electron microscope. SRMs 473 and 475 are patterned with antireflecting chromium on quartz; SRM 476 is patterned with bright chromium on glass.

SRM	Type	Linewidth (in μm)	Pitch (in μm)	Unit Size (in cm)
473	Linewidth Measurement Standard	0.5 to 30	2 to 70	12.7×12.7×0.23
475	Linewidth Measurement Standard	0.9 to 10.8	2 to 38	6.35×6.35×0.15
476	Linewidth Measurement Standard	0.9 to 10.8	2 to 38	6.35×6.35×0.15

207. Depth Profiling (wafer form)

SRMs 2134 and 2137 are for calibrating the secondary ion response to minor and trace element levels in a silicon matrix. SRM 2134 is certified for arsenic; SRM 2137 is certified for boron. SRMs 2135c and 2136 are for calibrating equipment used to measure sputtered depth and erosion rates in surface analysis. SRM 2135c will be certified for total chromium and total nickel thickness, for individual layer uniformity, for nickel/chromium bilayer uniformity, and for individual layer thickness. SRM 2136 is certified for total chromium thickness of seven individual layer thicknesses.

SRM	Type	Value	Unit/Size (in cm)
2134	Arsenic Inplant in Silicon Depth Profile Standard	$^{75}As - 7\times10^{14}$ atoms/cm^2	1×1
2135c	Nickel-Chromium Thin-Film Depth Profile Standard	In Prep	1×2.54×0.04
2136	Chromium/Chromium Oxide Thin-Film Depth Profile Standard	175.3 μm/cm^2	1×2.54×0.04
2137	Boron Implant in Silicon Depth Profile Standard	$^{10}B - 1.018\times10^{15}$ atoms/cm^2	1×1

207. Optoelectronics (solid forms)

These SRMs are intended for calibrating equipment (tunable diode lasers, video microscopes, optical retarders, etc.) and measurement systems used in the manufacture and testing of optical fiber. SRM 2518 is a device with a stable and known polarization mode dispersion which simulates optical fiber; SRMs 2517 and 2519 are fiber-connected molecular gas absorption cells with lines in the 1520 to 1570 nm region; SRM 2520 is an optical fiber specimen with a known cladding diameter value; SRM 2521 is a glass specimen with a known diameter and a refractive index approximating that of the polymer coating on fiber; SRM 2522 is a steel wire, with a known diameter, like that used to size bores in fiber connector ferrules; SRM 2523 is a ceramic connector ferrule with a specified outside diameter and roundness; SRM 2524 is an optical fiber with a known zero dispersion wavelength; SRM 2525 is a nominally 90° retarder with a known retardance.

SRM	Type	Certified Property
2517	Wavelength Reference Absorption Cell (Acetylene)	$\upsilon_1 + \upsilon_3$ band, in nm
2518	Polarization Mode Dispersion Standard	In Prep
2519	Wavelength Reference Absorption Cell (Hydrogen Cyanide)	In Prep
2520	Optical Fiber Diameter Standard	125 μm D, nominal
2521	Optical Fiber Coating Standard	In Prep
2522	Pin Gauge Standard for Optical Fiber Ferrules	126 μm D, nominal
2523	Optical Fiber Ferrule Geometry Standard	2.5 mm D, nominal
2524	Optical Fiber Chromatic Dispersion Standard	λ_0 = 1550 nm, nominal
2525	Optical Retardance Standard	δ = 90 °, nominal

207. Chromium Over Copper on Steel (plate form)

These SRMs are suitable for calibrating instruments used in the measurement of organics and nonmagnetic inorganic coatings over steel. They consist of fine grained copper of varying thicknesses electrodeposited onto low carbon steel substrates having the properties of AISI 1010 steel. These uniform coatings are then overplated with a thin protective layer of chromium and the total coating thickness is then certified. The thickness range covered is between 2.5 μm and 2000 μm. **NOTE:** A recertification service for units of this SRM, whose certification has expired, is available from the NIST Metallurgy Division. Contact the Division for details: Phone: (301) 975-6411; Fax: (301) 975-4553.

SRM	Unit Size	Coating Thickness, nominal	
	30×30 mm	(in mils)	(in μm)
1357	Set of 3	0.2, 0.8, 2.0	base, 6, 20, 48
1358a	Set of 3	3.1, 9.8, 39	base, 80, 225, 1000
1359	Set of 4	2.0, 5.5, 20, 32	48, 140, 505, 800
1360	Set of 4	0.1, 0.2, 0.5, 0.8	2.5, 6, 12, 20
1361a	Set of 4	0.2, 0.5, 1.0, 2.0	6, 12, 25, 48
1362b	Set of 4	1.6, 3.1, 5.5, 7.9	40, 80, 140, 205
1363a	Set of 4	9.8, 16, 20, 26	255, 385, 505, 635
1364a	Set of 4	32, 39, 59, 79	800, 1000, 1525, 1935

207. Solder Thickness (plate form)

This SRM is for calibrating x-ray fluorescence equipment. Each unit, which consists of a 1.5 cm×1.5 cm plate of an electroplated tin-lead alloy coating on a copper substrate, is individually certified for composition and mass per unit area.

SRM	Type	Composition	Coating Mass/Area, nominal (in mg/cm^2)	Coating Thickness, estimated	
				(in μin)	(in μm)
2321	Tin-Lead Alloy	Sn: 60 Pb: 40	6.8	295	7.5

207. Ellipsometry (wafer form)

These SRMs are issued primarily to evaluate the accuracy of ellipsometers and can also be used as an aid in the calibration of various other optical thickness monitoring instruments. Each unit is certified for the ellipsometric parameters delta (Δ) and psi (Ψ) at the vacuum wavelength $\lambda = 633.0$ nm, and for the derived values of the thicknesses and indexes of refraction of the silicon dioxide and silicon layers.

SRM	Type	Substrate Size (in mm)	Thickness (in nm)
2531	Thin Film Thickness	76 D	50
2532	Thin Film Thickness	76 D	100
2533	Thin Film Thickness	76 D	200
2534	Thin Film Thickness	76 D	25
2535	Thin Film Thickness	76 D	14
2536	Thin Film Thickness	76 D	10

207. Oxygen Concentration in Silicon (wafer form)

SRM 2551 is for the calibration of infrared spectrophotometers used to measure the 1107 cm^{-1} interstitial oxygen peak in silicon. Each unit is individually certified and consists of a set of three silicon wafers; one each of a low, medium and high oxygen level Czochralski specimen. A float zone specimen of minimum oxygen concentration is also included in each set. Certified values are provided in ppma, mg/kg and atoms/cm.

SRM	Type	Unit Size (in cm)	Concentration (in mg/kg, nominal)
2551	Oxygen in Silicon	Set of 4: 2.5×2.5×0.2	L – 10 M – 13 H – 15 FZ – (<0.1)

208. Ceramics and Glasses

Chemical Resistance [Durability] of Glass (solid form)

These SRMs are for checking test methods and calibrating equipment used to determine the resistance of glass containers to chemical attack. The values given represent the volume of 0.02 N sulfuric acid used to titrate to the methyl red end point of the alkaline extract from a crushed sample of glass after exposure to high purity water at 121 °C.

SRM	Type	Unit Size	mL of N/50 H_2SO_4
622	Soda-Lime Silica	2.2 kg	7.67
623	Borosilicate	2.2 kg	0.34

208. Electrical Properties of Glass (bar form)

SRM 624 is for checking test methods and for calibrating equipment used to determine the dc volume resistivity of glass per ASTM C 657. SRM 774 is for checking methods used to determine dielectric constant and ac loss characteristics of insulating materials per ASTM D 150.

SRM	Type	Unit Size (in cm)	Value
624	Lead-Silica, for dc resistivity	5×5×0.5	$\log_{10}\rho$~9.9 Ω-cm at 300 °C
774	Lead-Silica, for dielectric constant	5×5×2.5	K~7.47 at 100 Hz

208. Viscosity of Glass (bar form)

SRMs 710a, 711a, and 717a are for checking the performance of high temperature viscosity equipment (rotating cylinders) and low temperature viscosity equipment (fiber elongation, beam bending, parallel plates, etc.).

SRM	Type	Temperature (°C) at Log 10 Viscosity (in Pa • s)										
		1	2	3	4	5	6	7	8	9	10	11
710a	Soda-Lime-Silica	1464	1205	1037	918							
711a	Lead-Silica	In Prep										
717a	Borosilicate	1555.4	1256.5	1065.1	932.1	(834)	(758)	(697)	(647)	(606)	(570)	(540)

Values in parentheses are not certified and are given for information only.

208. Glass Liquidus Temperature (solid form)

This SRM is for checking test methods and for calibrating equipment used to determine the liquidus temperature of glass by the gradient furnace methods per ASTM C 829.

SRM	Type	Unit Size	Method	Temperature, °C
773	Soda-Lime-Silica	2.5 cm×2.5 cm×0.6 cm	A (boat)	988
			B (perforated plate)	991

208. Viscosity Fixpoints (solid forms)

These SRMs are for the calibration of equipment for the determination of the softening, annealing, and strain points of glass. SRM 709 is also used to measure relative stress optical coefficient. [Also see next table.].

SRM	Type	Unit Size	Softening Point, °C	Annealing Point, °C	Strain Point, °C
709	Extra Dense Lead Silica	4 cm×4 cm×5 cm	384	328	311
710a	Soda-Lime-Silica	10 cm×10 cm×4 cm	730.6	(545)	(504)
713	Dense Barium Crown 620/603	225 g	738	631	599
714	Alkaline Earth Alumina Silicate	225 g	908	710	662
716	Neutral	250 g	794	574	530
717a	Borosilicate	4.2 cm×4.2 cm×12.5 cm	(719)	(513)	(470)

Values in parentheses are not certified and are given for information only.

208. Relative Stress Optical Coefficient (bar form)

This SRM is for calibrating instruments used to measure the relative stress optical coefficient of glass.

SRM	Type	Unit Size	Relative Stress Optical Coefficient (C) at λ=546.1 nm (Value × 10^{-12} m^2/N)
709	Extra Dense Lead Silica	4 cm×4 cm×5 cm	C = −1.359

208. Density and Refractive Index (solid form)

These SRMs are for reference in the determination of the density of solids. The certified refractive indexes of SRM 1820 at 13 wavelengths were measured with a precision spectrometer. A value for the sodium D_1, D_2 line is given. The certified densities of SRMs 1826a and 1827a were determined by means of hydrostatic weighing.

SRM	Type	Unit Size	Density (in g/cm^3)	Refractive Index*
1820	Borosilicate Glass	slab – 3.8 cm×3.8 cm×0.6 cm	(2.292)	1.49669
1826a	Soda-Lime Glass	slab – 0.8 cm×2.0 cm×4.0 cm	2.548932	
1827a	Lead Silica Glass	slab – 0.5 cm×2.5 cm×1.2 cm	3.593014	

*Value is at 20 °C and 435.83 nm (mercury spectral source).
Values in parentheses are not certified and are given for information only.

209. X-Ray Spectrometry

X-Ray Diffraction (powder and solid forms)

SRMs 656, 676, 674a, and 1878a consist of high phase purity materials for use in the quantitative analysis of samples by the internal standard method. SRM 656, a silicon nitride, is certified for both α and β polymorphs. SRMs 640c, 660, 675, and 1976 consist of materials with select crystallographic and microstructure properties used in the evaluation of diffraction equipment for the following variables; 1) d-spacing or line position, 2) line or instrument intensity, and 3) instrumental or sample contributions to the shape of reflection profiles. SRM 1976, a sintered alumina plate, is also certified with respect to lattice parameters as well as 12 relative intensity values from 25° to 145° 2Θ (Cu K_α). SRM 1990 will be certified for lattice parameter. SRM 2910 is a high purity synthetic calcium hydroxyapatite for which line profile, relative intensity, lattice parameter, and crystallographically disordered material fraction reference data have been provided.

SRM	Type	XRD Application	Lattice Parameters (in nm)	Unit Size (in g)
640c	Silicon Powder 2Θ/d-Spacing	Line Position		In Prep
656	Silicon Nitride	Quantitative Analysis	α-(0.7752630/0.5619372)	10
			β-(0.7602293/0.2906827)	10
660	LaB_6-2Θ	Line Profile	0.415695	3
674a	Powder Diffraction Intensity	Quantitative Analysis		
	α-Al_2O_3 (corundum)		(0.4759397/1.299237))	10
	CeO_2 (fluorite)		(0.5411102)	10
	Cr_2O_3 (corundum)		(0.4959610/1.358747)	10
	TiO_2 (rutile)		(0.4593939/0.2958862)	10
	ZnO (wurtzite)		(0.3249074/0.5206535)	10
675	Mica Low 2Θ	Line Position	0.998104	7.5
676	Alumina (corundum)	Quantitative Analysis	0.475919/1.299183	20
1878a	Respirable Quartz	Quantitative Analysis		In Prep
1976	Alumina Plate, Sintered	Instrument Sensitivity	0.4758846/1.299306	4.5 cm×4.5 cm×0.16 cm
1990	Ruby Sphere	Quantitative Analysis		In Prep
2910	Calcium Hydroxyapatite	Quantitative Analysis	(a-0.942253) (c-0.688501)	5

Values in parentheses are not certified but are provided as reference values or are given for information only.

209. X-Ray Stage Calibration (solid forms)

These SRMs are to be used to check the dimensional accuracy of x-ray inspection systems.

SRM	Type	Unit Size (in mm)
1842	Calibration Board (X and Y dimensions)	Board: 300 × 300 × 3
1843	Calibration Specimen (Z dimension)	Triangular Block: 37 × 20 × 12

Engineering Materials

Standard Reference Materials for Engineering Materials

301. Sizing

Particle Size (powder and solid forms)

These SRMs are for evaluating and calibrating specific types of particle size measuring instruments, including light scattering, electrical zone flow-through counters, optical and scanning electron microscopes, sedimentation systems, and wire cloth sieving devices. SRM 659 consists of equiaxed silicon nitride particles with a minimal amount of large agglomerates; SRM 1978 consists of granular, irregular shaped zirconium oxide particles with a minimal amount of large agglomerates; SRM 1982 consists of spheroidal particles measured using scanning electron microscopy, laser scattering, and sieving. SRMs 1003b, 1004a, 1017b, 1018b and 1019b each consist of soda-lime glass beads covering a particular size distribution range. SRMs 1690, 1691, 1692 and 1963 are commercially manufactured latex particles in a water suspension. SRMs 1960 and 1961 (also called "space beads") are latex particles in a water suspension produced by the National Aeronautics and Space Administration (NASA) during the Challenger STS-6 and STS-11 missions, respectively. SRM 1965 consists of two different groupings of the SRM 1960 particles.

SRM	Type	Particle Size Diameter, nominal (in μm)	Unit Size
659	Silicon Nitride	0.2 to 10	5 vials: 2.5 g each
1003b	Glass Beads	10 to 60 (600 to 325 mesh)	25 g
1004a	Glass Beads	40 to 170 (325 to 100 mesh)	70 g
1017b	Glass Beads	100 to 400 (140 to 45 mesh)	70 g
1018b	Glass Beads	220 to 750 (60 to 25 mesh)	87 g
1019b	Glass Beads	750 to 2450 (20 to 10 mesh)	200 g
1690	Polystyrene (0.5 % in H_2O)	0.895	5 mL vial
1691	Polystyrene (0.5 % in H_2O)	0.269	5 mL vial
1692	Polystyrene (0.25 % in H_2O)	2.982	5 mL vial
1960	Polystyrene (0.4 % in H_2O)	9.89	5 mL vial
1961	Polystyrene (0.5 % in H_2O)	29.64	5 mL vial
1963	Polystyrene (0.5 % in H_2O)	0.1007	5 mL vial
1965	Polystyrene	9.84 (hexagonal array) 9.89 (unordered clusters)	1 slide
1978	Zirconium Oxide	0.33 to 2.19	5 g
1982	Zirconium Oxide	10 to 150	10 g

301. Cement Turbidimetry and Fineness

This SRM is for calibrating the Blaine fineness meter according to the latest issue of Federal Test Method Standard 158, Method 2101 or ASTM C 204 to calibrate the Wagner turbidimeter according to ASTM C 115 and to determine sieve residue according to ASTM C 430. Each set consists of twenty sealed laminated film pouches, each containing approximately 10 g of cement.

SRM	Type	Properties Certified	Value
114p	Portland Cement	Residue on 45 μm (No. 325) sieve	8.24 %
		Specific Surface area (Wagner turbidimeter)	2086 $cm^2 \cdot g^{-1}$
		Specific Surface area (Air permeability)	3774 $cm^2 \cdot g^{-1}$

301. Electrophoretic Mobility, μ_E (suspension form)

SRM 1980 is intended for use in the calibration and evaluation of equipment used to measure electrophoretic mobility. It consists of a goethite suspension saturated with phosphate in a sodium perchlorate electrolyte solution.

SRM	Type	Property Certified	Unit Size
1980	Goethite (α–FeOOH)	$+\mu_E$, -2.53 μm • cm/V • s	40 mL

301. Surface Area of Powders

These SRM and RM materials are for calibrating and checking instruments used to determine the specific surface area of powders by the Brunauer, Emmett and Teller (BET) method. The surface areas of SRMs 1899 and 1900 and RMs 8570, 8571, and 8572 (issued by NIST in cooperation with the ASTM) were determined by both the static (volumetric) and single point methods.

SRM	Type	Surface Area (in m^2/g)		Unit Size (in g)
		Static	Single Point	
1899	Silicon Nitride	10.67	10.52	In Prep
1900	Silicon Nitride			In Prep
RM 8570	Calcined Kaolin	10.9	10.3	25
RM 8571	Alumina	158.7	153.2	25
RM 8572	Silica-Alumina	291.2	277.6	25

301. Particle Count Materials (powder and suspension forms)

These SRM and RM materials are intended for use in calibrating the response of particle sizing instrumentation, including optical counters, in accordance with National Fluid Power Association (NFPA) and ISO standard methods for determining particle contamination in oils. SRM 2806 is certified for particle concentration and projected area diameter. It consists of a polydisperse, irregularly-shaped mineral dust suspended in 5606 hydraulic fluid. RMs 8631 and 8632 are mineral test dusts of medium and ultrafine particle size and can be used to prepare suspensions in other types of oils. **NOTE:** The same lot of medium test dust was used to produce SRM 2806 and RM 8631.

SRM	Type	Particle Concentration	Unit Size
2806	Medium Test Dust (MTD) in Hydraulic Fluid	2.8 mg/L, nominal	2 × 400 mL
RM 8631	Medium Test Dust (MTD)	In Prep	
RM 8632	Ultrafine Test Dust (ULTD)	In Prep	

302. Surface Finish

Microhardness (block form)

These SRMs are for use in calibrating and checking the performance of microhardness testers. SRMs 1893 through 1907 are 1.25 cm×1.25 cm (SRM 2798 is 1.35 cm×1.35 cm) and were made by electroforming the test metal on AISI 1010 steel substrate. SRMs 2830 and 2831 are intended to meet the needs of the structural, electronic and biomedical ceramics communities.

SRM	Type	Load (in Newtons)	Hardness, nominal (in kg/mm^2)
1893	Bright Copper (Knoop)	0.245, 0.490, 0.981	125
1894	Bright Copper (Vickers)	0.245, 0.490, 0.981	125
1895	Bright Nickel (Knoop)	0.245, 0.490, 0.981	600
1896	Bright Nickel (Vickers)	0.245, 0.490, 0.981	600
1905	Bright Nickel (Knoop)	2.943	600
1906	Bright Nickel (Knoop)	4.905	600
1907	Bright Nickel (Knoop)	9.81	600
2798	Bright Nickel (Vickers)	4.905	600
2830	Ceramic, Silicon Nitride (Knoop)	19.6	1500
2831	Ceramic, Tungsten Carbide (Vickers)	9.81	In Prep

302. Abrasive Wear (block form)

This SRM is for use in the dry sand/rubber wheel abrasion test per ASTM G 65, Procedure A.

SRM	Type	Unit Size (in cm)
1857	D–2 Tool Steel	2 blocks: 0.78×2.5×7.6

302. Corrosion (plate form)

This SRM is for determining the reliability of step test measurements of electrochemical potential and thickness of multilayered nickel deposits. It consists of a 5.0 cm×5.0 cm plate of copper-plated steel over which a duplex nickel coating has been deposited.

SRM	Type	Step Test Potential (in mV)	Nickel Coating Thickness (in μm)	
			Bright	Semibright
2350	Nickel Step Test	110 to 150	7	20

302. Surface Roughness (block form)

These SRMs are for calibrating stylus instruments that measure surface roughness. These electroless-nickel coated steel blocks have a sinusoidal roughness profile machined on the top surface.

SRM	Type	Roughness, R_a (in μm)	Wavelength, D (in μm)	Unit Size (in cm)
2071b	Sinusoidal Roughness	0.3	100	In Prep
2073a	Sinusoidal Roughness	3.0	100	block: 2.4×3.3
2074	Sinusoidal Roughness	1.0	40	block: 2.4×3.3
2075	Sinusoidal Roughness	1.0	800	block: 2.4×3.3

303. Nondestructive Evaluation

Dye Penetrant Test Blocks

These SRMs are for checking the performance of liquid dye penetrants and dye penetrant crack detection systems and devices for surface defect detection. These test blocks, composed of a laminate cross section of electrodeposited nickel and copper, have four synthetic cracks, approximately 0.2 μm, 0.5 μm, 1 μm, and 2 μm wide.

SRM	Type	Surface	Unit Size (in cm)
1850	Penetrant Test Block	Bright Finish	5D×1
1851	Penetrant Test Block	Matte Finish	5D×1

303. Artificial Flaw for Eddy Current NDE

RM 8458 provides a flaw of known size and geometry that closely resembles an actual fatigue crack. It is intended to produce a response suitable for calibrating eddy current nondestructive evaluation (NDE) systems. The flaw size is 3.0 mm×0.1 mm long by 1.0 mm deep in a 7 cm×7 cm×2 cm block of 7075–T651 aluminum alloy, heat treated to the T6 temper.

303. Magnetic Particle Inspection

SRM 1853 provides a means for obtaining a leakage field of known value. Such a field is useful for verifying the magnetic properties of particles used in Magnetic Particle Inspection (MPI). Each individually calibrated ring was machined from vacuum arc remelted 52100 steel and has a series of holes machined at various depths below the surface.

SRM	Type	Leakage Field Gradient (in Oe/cm)		Unit Size (in cm)
1853	Magnetic Particle Test Ring	min. A max. A	50 to 2000 100 to 2500	12.7D×2.2

304. Automatic Data Processing — Discontinued

305. Fire Research

Surface Flammability (sheet form)

This SRM is for checking the operation of radiant panel test equipment in accordance with the procedures outlined in ASTM E 162–78.

SRM	Type	Certification	Unit Size (in cm)
1002d	Hardboard Sheet	Flame Spread Index, I = 153 Heat Evolution Factor, Q = 36.5	Set of 4: 15.2×45.7×0.63

305. Smoke Density Chamber (sheet form)

This SRM is certified for maximum specific optical density and for performing operational checks of smoke density chambers.

SRM	Type	Maximum Specific Optical Density	Unit Size (in cm)
1007b	Flaming Exposure Condition (plastic)	Dm (corr.)=421 to 493	3 sheets: 25.4×25.4×0.076

305. Smoke Toxicity (granular and sheet forms)

SRM 1048 is for checking the operation of the Cup Furnace Smoke Toxicity Method under two observation periods. It consists of eight sheets, 16 cm×16 cm×0.76 cm each, of acrylonitrile-butadiene-styrene copolymer. SRM 1049 is for checking the operation of the University of Pittsburgh I Smoke Toxicity Method. It consists of 150 g of Nylon 6/6 granules which is enough to determine the LC_{50} value four times.

SRM	Type	Combustion Mode	Observation Time	Values	
				LC_{50}	N-Gas
1048	Smoke Toxicity (ABS sheets)	Flaming	WE*	27	1.4
			WE & PE**	25	1.5
		Nonflaming	WE*	58	1.2
			WE & PE**	53	1.4
1049	Smoke Toxicity (Nylon 6/6)		30–min. exposure 10–min. post-exposure	4.4	

*WE = within 30 min.
**WE & PE = 30 min+14 d.

305. Flooring Radiant Panel (sheet form)

This SRM consists of three sheets of kraft paperboard. It is for checking the operation of flooring radiant panel test apparatus used to measure critical radiant flux as per ASTM E 648.

SRM	Type	Critical Radiant Flux	Unit Size (in cm)
1012	Flooring Radiant Panel	0.36 W/cm^2	104.1×25.4×0.305

309. Miscellaneous Performance Engineering Materials

309. Charpy V-Notch Test Blocks

These SRMs are test specimens intended for the certification of Charpy V-Notch testing machines in accordance with both ASTM Standard E 23 and ISO/DIS 12736 dimensional requirements. Each SRM unit consists of five 10 mm×10 mm×54 mm steel bars. SRMs 2092 and 2096 are made from 4340 alloy steel; SRM 2098 is made from a high strength maraging steel. SRMs 2092 and 2096 are to be tested at –40 °C; SRM 2098 is to be tested at room temperature (20 °C to 22 °C). All SRMs are to be tested in accordance with the testing procedures of the appropriate section of the current ASTM Standard E 23. All SRM bar specimens should be tested (broken) at the same time, then returned to NIST Boulder for evaluation. An acceptable machine will produce an average value within 1.4 J or 5 % of the certified energy value, whichever is greater, provided the specimens appear to have normal markings.

SRM	Type	Energy Range		
		(in J)	(in kgf • m)	(in ft • lbf)
2092	Low Energy	12.2 to 20.3	1.24 to 2.07	9.0 to 15.0
2096	High Energy	88.1 to 115.2	8.98 to 11.75	65.0 to 85.0
2098	Super High Energy	210.0 to 230.0	21.40 to 28.43	155.0 to 170.0

309. Socketed Ball Bar

This SRM is for measuring the performance of coordinate measuring machines (CMMs) as per ASME Standard B89.1.12. It consists of a set of three precision balls pinned and cemented onto threaded shafts, one table-mount magnetic socket, one ram-mount magnetic socket, and five partially insulated extension tubes—50 mm, 100 mm, 200 mm, 400 mm, and 800 mm long.

SRM	Type	Measuring Lengths (in 50 mm steps)	Unit Size
2083	Socketed Ball Bar	100 to 1650	Set

309. Coordinate Measuring Machine (CMM) Probe Performance

These SRMs are designed to aid in the performance evaluation of CMMs and their subsystems in accordance with American National Standard ASME B89.4.1 "Methods for Performance Evaluation of Coordinate Measuring Machines" and related international standards. SRM 2084 consists of a precision 10 mm tungsten carbide sphere and stem and a stand which allows the sphere to be mounted in either a horizontal, vertical, or 45° orientation. SRMs 2084R and 2085 are separate 10 mm tungsten carbide and 25 mm stainless steel spheres, respectively, that can be used with SRM 2084 to provide multiple or alternative artifact configurations. All spheres are calibrated for both form (roundness) and size (diameter).

SRM	Type	Unit Size
2084	CMM Probe Performance	one 10 mm sphere stem and stand
2084R	CMM Probe Performance	one 10 mm sphere (stem only)
2085	CMM Probe Performance	one 25 mm sphere (stem only)

309. Tape Adhesion Testing (sheet form)

This SRM is intended as a uniform source of linerboard for use with ASTM Standards D 2860 Standard Test Method for Adhesion of Pressure-Sensitive Tape to Fiberboard at 90° Angle and Constant Stress, D 3654 Standard Test Method for Holding Power of Pressure-Sensitive Tapes, and D 3889 Standard Method for Adherence to Linerboard of Pressure-Sensitive Tapes at Low Temperature.

SRM	Type	Unit Size
1810a	Linerboard for Tape Adhesion Testing	50 sheets: 21.6 cm×28 cm

309. Bleached Kraft Pulps (sheet form)

RM 8495 Northern Softwood Bleached Kraft Pulp and RM 8496 Eucalyptus Hardwood Bleached Kraft Pulp are intended primarily for use in fundamental studies on the physical properties of fibers and paper sheets. The materials selected for these two RMs are bleached dried lap pulp, each from a single lot of a standard commercial production run. The materials were selected because of their differing fiber size, differing papermaking properties, and similarity to commercially available materials.

RMs 8495 and 8496 were developed and prepared with input and support from the Pulp Material Research Committee (PMRC), a subcommittee of the Fundamental Research Committee. These materials were donated by industry and are being distributed by the SRM Program. At this time, no extensive property measurements have been made on these materials beyond ensuring they were within the control limits of the normal production run. A measurement error study is in progress with participation by international paper technical laboratories. As results become available, they will be published and added to the Report of Investigation that accompanies each of these materials.

RM	Type	Unit Size
8495	Northern Softwood	10 standard lap sheets ×0.5 kg
8496	Eucalyptus Hardwood	10 standard lap sheets ×0.5 kg

NIST Special Publications in the 260 Series

NIST Special Publications in the 260 Series

Trahey, N. M., editor, **NIST Standard Reference Materials Catalog (1997–98 edition),** NIST Spec. Publ. 260 (October 1997).

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Michaelis, R. E., Yakowitz, H., and Moore, G. A., **Standard Reference Materials: Metallographic Characterization of an NBS Spectrometric Low-Alloy Steel Standard,** NBS Misc. Publ. 260–3 (October 1964). COM74–11060

Hague, J. L., Mears, T. W., and Michaelis, R. E., **Standard Reference Materials: Sources of Information,** Publ. 260–4 (February 1965). COM74–11059

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1059c	Lead (Metallo-Organic)	Sep 87	114	95
1060a	Lithium (Metallo-Organic)	Apr 64	114	95
1065b	Nickel (Metallo-Organic)	Nov 93	114	95
1066a	Silicon (Metallo-Organic)	Jun 91	114	95
1069b	Sodium (Metallo-Organic)	Jun 91	114	95
1070a	Strontium (Metallo-Organic)	Apr 64	114	95
1071b	Phosphorus (Metallo-Organic)	Sep 91	114	95
1073b	Zinc (Metallo-Organic)	Sep 86	114	95
1075a	Aluminum (Metallo-Organic)	Oct 67	114	95
1077a	Silver (Metallo-Organic)	Feb 68	114	95
1078b	Chromium (Metallo-Organic)	Jul 72	114	95
1079b	Iron (Metallo-Organic)	Feb 69	114	95
1080a	Copper (Metallo-Organics)	Feb 69	114	95
1083	Wear Metals (Base Oil)	Jul 91	114	96
1084a	Wear Metals	Apr 91	114	96
1085a	Wear Metals	Apr 91	114	96
1089	Steels, Set (SRMs 1095-99)	Apr 86	101	34

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1090	Ingot Iron, Oxygen	Nov 85	101	34
1091a	Stainless Steel (AISI 431)	Nov 85	101	34
1093	Valve Steel, Oxygen	Nov 84	101	34
1094	Maraging Steel	Nov 84	101	34
1095	Steel (AISI 4340) [see SRM 1089]	Apr 86	101	34
1096	Steel (AISI 94B17) [see SRM 1089]	Apr 86	101	34
1097	Cr-V Steel (mod.) [see SRM 1089]	Apr 86	101	34
1098	Steel (High Carbon) [see SRM 1089]	Apr 86	101	34
1099	Electrolytic Iron [see SRM 1089]	Apr 86	101	34
1104	Free-Cutting Brass	Aug 65	102	46
1107	Naval Brass B	Nov 81	102	46
1108	Naval Brass C	Nov 81	102	46
1110	Red Brass B	Oct 81	102	46
1111	Red Brass C	Oct 81	102	46
1112	Gilding Metal A (disk)	Oct 81	102	46
C1112	Gilding Metal A (block)	Oct 81	102	46
1113	Gilding Metal B (disk)	Oct 81	102	46
C1113	Gilding Metal B (block)	Oct 81	102	46
1114	Gilding Metal C (disk)	Oct 81	102	46
C1114	Gilding Metal C (block)	Oct 81	102	46
1115	Commercial Bronze A (disk)	Nov 81	102	46
C1115	Commercial Bronze A (block)	Nov 81	102	46
1116	Commercial Bronze B (disk)	Nov 81	102	46
C1116	Commercial Bronze B (block)	Nov 81	102	46
1117	Commercial Bronze C (disk)	Nov 81	102	46
C1117	Commercial Bronze C (block)	Nov 81	102	46
C1122	Beryllium-Copper (block)	Dec 81	102	46
C1123	Beryllium-Copper (block)	Discontinued		
1128	Ti Alloy, V-Al-Cr-Sn	Jul 91	102	51
1129	Solder 63Sn-37Pb	May 89	102	49
1131	Solder 60Pb-40Sn	Oct 81	102	49
1132	Bearing Metal (Pb-Sn)	Nov 94	102	49
1134	LA Steel, High Silicon	Apr 70	101	36
1135	LA Steel, High Silicon	Jul 72	101	36
C1137a	White Cast Iron	Sep 96	101	43
1138a	Cast Steel (No. 1)	Jan 77	101	43
1139a	Cast Steel (No. 2)	Jan 77	101	43
C1145a	White Cast Iron	Jan 88	101	43
C1146a	White Cast Iron	Discontinued		
C1151a	Stainless Steel 23Cr-7Ni	Dec 92	101	40
C1152a	Stainless Steel 18Cr-11Ni	Feb 90	101	40
C1153a	Stainless Steel 17Cr-9Ni	Sep 90	101	40
C1154a	Stainless Steel 19Cr-13Ni	Jun 92	101	40
1155	Stainless Steel Cr-Ni-Mo (AISI 316)	Aug 69	101	40
1157	Specialty Steel, Tool (AISI M2)	Aug 73	101	40
1158	Specialty Steel, High Nickel (Ni36)	Dec 77	101	40
1159	Elec/Mag Ni-Fe	Aug 81	102	50
1160	Elec/Mag Ni-Mo-Fe	Aug 81	102	50
1171	Stainless Steel Cr-Ni-Ti (AISI 321)	May 93	101	40
1172	Stainless Steel Cr-Ni-Nb (AISI 348)	Jul 71	101	40
1173	Ni-Cr-Mo-V Steel	Jun 89	101	43
C1173	Cast Steel 3	Jan 89	101	43
1216	Carbon Modified Silicon	Nov 87	106	69
1218	LA Steel, High Silicon	Nov 84	101	36
1219	Stainless Steel Cr-Ni (AISI 431)	Sep 85	101	40
C1221	LA Carbon (AISI 1211)	Apr 93	101	36
1222	LA Steel, Cr-Ni-Mo (AISI 8640)	Sep 90	101	36
1223	Chromium Steel	May 93	101	40
1224	LA Steel, Carbon (AISI 1078)	Feb 81	101	36
1225	LA Steel (AISI 4130)	Mar 83	101	36
1226	LA Steel	Sep 96	101	36
1227	LA Steel, Basic Open Hearth, 1% C	Mar 83	101	36
1228	LA Steel, 0.1% C	Jun 93	101	36
1230	High Temp. Alloy, A286	Jun 87	101	39
1233	Specialty Steel, Valve Steel	Mar 92	101	40
1235	Zirconium B for Hf	Discontinued		
1242	High Temp. Alloy L-605	Nov 91	102	44
1243	Waspaloy™	Jan 89	102	50
1244	Inconel™ 600	May 84	101	50
1245a	Inconel™ 625	May 84	101	50
1246	Incoloy™ 800	May 84	101	39
1247	Incoloy™ 825	May 84	101	39
C1248	Nickel-Copper Alloy	Dec 86	102	50
1249	Inconel™ 718	Mar 96	102	50
1250	High Temp. Alloy Fe-Ni-Co	Jul 93	101	39
C1252	Phos. Copper IX	Apr 86	102	47
C1253	Phos Copper X	Discontinued		
1254	LA Steel (Ca only)	Apr 82	101	36
1258	Aluminum Alloy 6011	May 78	102	44
1259	Aluminum Alloy 7075	May 78	102	44
1261a	LA Steel (AISI 4340)	May 93	101	36
1262b	LA Steel (AISI 94B17)	Oct 92	101	36
1263a	LA Steel Cr-V (mod.)	Feb 81	101	36
1264a	LA Steel, High Carbon (mod.)	Jan 88	101	36
1265a	Electrolytic Iron	Jun 89	101	36
1269	Line Pipe (AISI 1521 mod.)	Jun 81	101	36
1270	LA Steel, Cr-Mo (A336) (F-22)	Jun 81	101	36
1271	LA Steel (HSLA-100)	Oct 91	101	36
1276a	Cupro-Nickel (CDA 715)	Jun 89	102	46
C1285	LA Steel (A242) (mod.)	Jun 82	101	36
1286	LA Steel HY 80	Mar 92	101	36
C1287	Stainless Steel (AISI 310 mod.)	Jun 81	101	40
C1288	Stainless Steel (A-743)	Aug 81	101	40
C1289	Stainless Steel (AISI 414 mod.)	Discontinued		
C1290	High Alloy (HC-250 + V)	Jan 85	101	43
C1291	High Alloy (Ni-Hard, Type I)	Jan 85	101	43
C1292	High Alloy (Ni-Hard, Type IV)	Jan 85	101	43
1295	Stainless Steel (SAE 405)	Mar 92	101	40
C1296	Stainless Steel 28Cr-3Mo (SAE 460)	Dec 91	101	40
1297	Stainless Steel Cr-Ni-Mn (SAE 201)	Dec 91	101	40
1357	Cu & Cr Coating on Steel	Jul 91	207	119
1358a	Cu & Cr Coating on Steel	In Prep	207	119
1359	Cu & Cr Coating on Steel	Jul 91	207	119
1360	Cu & Cr Coating on Steel	Jul 91	207	119
1361a	Cu & Cr Coating on Steel	Jul 91	207	119
1362b	Cu & Cr Coating on Steel	In Prep	207	119
1363a	Cu & Cr Coating on Steel	Jul 91	207	119
1364a	Cu & Cr Coating on Steel	Jul 91	207	119
1371	Gold Coating on Fe-Ni-Co Alloy	Discontinued		
1373	Gold Coating on Fe-Ni-Co Alloy	Discontinued		
1374	Gold Coating on Fe-Ni-Co Alloy	Discontinued		
1400	Bone Ash	Dec 92	105	62
1411	Soft Borosilicate Glass	Aug 85	112	91
1412	Multicomponent Glass	Aug 85	112	91
1413	Glass Sand (High Alumina)	Aug 85	111/112	88/91
1414	Lead-Silica (Resistivity)	Discontinued		
1416	Glass Al-Silicate (Glass Liquidus)	Discontinued		
1449	Fumed Silica Board	Jan 89	203	107
1450c	Fibrous Glass Board	Mar 97	203	107
1452	Fibrous Glass Blanket	Apr 86	203	107
1453	Expanded Polystyrene Board	Dec 96	203	107
1457	Superconducting Nb-Ti Wire	Jun 84	206	117
1459	Fumed Silica Board	Jan 89	203	107
1461	Stainless Steel (Therm./Elec. Resist.)	May 84	203/206	107/117
1462	Stainless Steel (Therm./Elect. Resist.)	May 84	203/206	107/117
1473a	Polyethylene Resin	Aug 95	202	101
1474	Polyethylene Resin	Apr 90	202	101
1475a	Polyethylene, Linear	Jun 96	202	101
1478	Polystyrene, Narrow Mol. Wt.	Jul 92	202	101
1479	Polystyrene, Narrow Mol. Wt.	Mar 92	202	101
1480	Polyurethane	Aug 92	202	101
1482a	Polyethylene, Linear	Dec 97	202	101
1483	Polyethylene, Linear	Mar 76	202	101
1484a	Polyethylene, Linear	Oct 92	202	101
1486	Bone Meal	Dec 92	105	62
1487	Poly (methylmethacrylate)	Jun 89	202	101

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1488	Poly (methylmethacrylate)	Feb 88	202	101
1489	Poly (methylmethacrylate)	Mar 86	202	101
1491	Arom. Hydro/Hexane Toluene	Aug 89	109	75
1492	Chlor. Pesticides/Hexane	Apr 92	109	75
1493	PCB Congeners	Feb 95	109	75
1496	Polyethylene Gas Pipe Resin	Sep 88	202	101
1497	Polyethylene Gas Pipe Resin	Jul 87	202	101
1507b	THC-COOH in Urine	Nov 94	105	64
1508a	Cocaine Metab. in Urine	In Prep	105	64
1511	Multi-Drugs of Abuse in Urine	Sep 94	105	65
1514	Thermal Analysis Purity Set (DSC)	Jul 84	203	104
1515	Apple Leaves	Jan 93	110	82
1543	GC/MS and LS System Performance	Aug 84	109	75
1544	Diet Composite	Feb 96	110	80
1547	Peach Leaves	Jan 92	110	82
1548a	Typical Diet	In Prep	110	80
1549	Non-Fat Milk Powder	Jul 85	110	79
1563	Coconut Oil	Nov 96	110	80
1566b	Oyster Tissue	In Prep	110	79
1567a	Wheat Flour	Sep 88	110	79
1568a	Rice Flour	Jan 88	110	79
1570a	Trace Elements in Spinach Leaves	Jul 96	110	82
1573a	Tomato Leaves	Nov 95	110	82
1575	Pine Needles	Feb 93	110	82
1577b	Bovine Liver	Aug 91	110	79
1580	Shale Oil	Nov 80	109	75
1581	PCBs in Oil	Jun 90	109	75
1582	Petroleum Crude Oil	Jan 84	109	75
1584	Phenols in Methanol	Apr 84	109	75
1586	Isotope Label Pollutants	Oct 84	109	75
1587	Nitro PAH in Methanol	Jun 85	109	75
1588a	Organics in Cod Liver Oil	In Prep	109	75
1589a	PCBs (Aroclor 1260) in Human Serum	In Prep	109	75
1595	Tripalmitin	Jul 83	105	62
1596	Nitropyrenes in Methylene Chloride	Jul 87	109	75
1597	Complex PAH Mix	May 92	109	75
1598	Inorg. Const. in Bovine Serum	Jan 90	105	62
1599	2 Anticonvulsant Drugs	Aug 82	105	62
1614	Dioxin in *Iso*octane	Jul 85	109	75
1616a	Sulfur in Kerosene	Sep 95	108	73
1617a	Sulfur in Kerosene	Jul 95	108	73
1618	Vanadium & Nickel in Fuel Oil	May 85	108	72
1619a	Sulfur in Residual Fuel Oil	Apr 91	108	73
1620b	Sulfur in Residual Fuel Oil	Jul 90	108	73
1621e	Sulfur in Residual Fuel Oil	Jul 96	108	73
1622e	Sulfur in Residual Fuel Oil	Apr 97	108	73
1623c	Sulfur in Residual Fuel Oil	Jul 96	108	73
1624c	Sulfur in Distillate Fuel Oil	Jun 97	108	73
1625	SO2 Permeation Tube-10 cm	May 95	107	71
1626	SO2 Permeation Tube-5 cm	May 95	107	71
1627	SO2 Permeation Tube-2 cm	Discontinued		
1629a	NO2 Permeation Device 1 cm	Discontinued		
1632b	Trace Elements in Coal (Bituminous)	Jun 97	108	73/74
1633b	Trace Elements in Coal Fly Ash	Jun 93	108	74
1634c	Trace Elements in Fuel Oil	Aug 95	108	72
1635	Trace Elements in Coal (Subbituminous)	Oct 95	108	73/74
1639	Halocarbons (in methanol)	Apr 83	109	75
1640	Natural Water	Oct 97	106	68
1641c	Mercury in Water	Jun 93	106	68
1643d	Trace Elements in Water	Jul 95	106	68
1646a	Estuarine Sediment	Jan 95	106/111	68/89
1647d	Priority Pollutant PAHs	Oct 96	109	75
1648	Urban Particulate Matter	Aug 91	106	68/69
1649a	Urban Dust/Organics	In Prep	109	75
1650a	Diesel Particulate Matter	In Prep	109	75
1655	KCl Solution Calorimetry	Mar 81	203	103
1656	Thianthrene Combustion Calorimetry	Jan 85	203	103
1657	Synthetic Refuse-Derived Fuel	May 93	203	103

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1658a	CH4/Air, 1 µmol/mol	Jun 93	107	71
1659a	CH4/Air, 10 µmol/mol	Aug 97	107	71
1660a	CH4-C3H8/Air, 1 µmol/mol	Nov 95	107	71
1661a	SO2/N2, 500 µmol/mol	Feb 97	107	71
1662a	SO2/N2, 1000 µmol/mol	Feb 97	107	71
1663a	SO2/N2, 1500 µmol/mol	Feb 97	107	71
1664a	SO2/N2, 2500 µmol/mol	Aug 96	107	71
1665b	C3H8/Air, 3 µmol/mol	May 97	107	71
1666b	C3H8/Air, 10 µmol/mol	May 97	107	71
1667b	C3H8/Air, 50 µmol/mol	Feb 97	107	71
1668b	C3H8/Air, 100 µmol/mol	Jan 97	107	71
1669b	C3H8/Air, 500 µmol/mol	Oct 96	107	71
1670a	CO2/Air, 300 µmol/mol	Discontinued		
1671a	CO2/Air, 340 µmol/mol	In Prep	107	71
1672a	CO2/Air, 350 µmol/mol	In Prep	107	71
1674b	CO2/N2, mol 7%	In Prep	107	70
1675b	CO2/N2, mol 14%	In Prep	107	70
1677c	CO/N2, 10 µmol/mol	Mar 94	107	70
1678c	CO/N2, 50 µmol/mol	Nov 95	107	70
1679c	CO/N2, 100 µmol/mol	Jun 97	107	70
1680b	CO/N2, 500 µmol/mol	Nov 95	107	70
1681b	CO/N2, 1000 µmol/mol	Nov 95	107	70
1683b	NO/N2, 50 µmol/mol	Dec 97	107	71
1684b	NO/N2, 100 µmol/mol	In Prep	107	71
1685b	NO/N2, 250 µmol/mol	Nov 96	107	71
1686b	NO/N2, 500 µmol/mol	Sep 96	107	71
1687b	NO/N2, 1000 µmol/mol	Nov 96	107	71
1690	Polystyrene (Particle Size)	Dec 82	301	127
1691	Polystyrene (Particle Size)	May 84	301	127
1692	Polystyrene (Particle Size)	May 91	301	127
1693a	SO2/N2, 50 µmol/mol	Aug 96	107	71
1694a	SO2/N2, 100 µmol/mol	Aug 96	107	71
1696a	SO2/N2, 3500 µmol/mol	Sep 96	107	71
1700a	CO2/N2, 10 mol (Blood Gas) %	Discontinued		
1701a	CO2-5%, O2-12 mol (Blood Gas) %/N2	Discontinued		
1702a	CO2-5%, O2-20 mol (Blood Gas) %/N2	Discontinued		
1703a	CO2-10%, O2-7 mol (Blood Gas) %/N2	Discontinued		
1710	Aluminum Alloy 3004	Jun 93	102	44
1711	Aluminum Alloy 3004	Jun 93	102	44
1712	Aluminum Alloy 3004	Jun 93	102	44
1713	Aluminum Alloy 5182	Jun 93	102	44
1714	Aluminum Alloy 5182	Jun 93	102	44
1715	Aluminum Alloy 5182	Jun 93	102	44
1744	Aluminum (Freezing Point)	Nov 94	203	105
1745	Indium (Freezing Point)	In Prep	203	105
1746	Silver (Freezing Point)	Jul 93	203	105
1747	Tin (Freezing Point)	Mar 97	203	105
1748	Zinc (Freezing Point)	Mar 97	203	105
1754	Steel (AISI 4320)	Feb 89	101	34
1761	LA Steel	Apr 92	101	36
1762	LA Steel	Apr 92	101	36
1763	LA Steel	Apr 92	101	36
1764	LA Steel	Feb 93	101	36
1765	LA Steel	Feb 93	101	36
1766	LA Steel	Feb 93	101	36
1767	LA Steel	Jun 93	101	36
1768	High-Purity Iron	Dec 91	101	36
1772	Tool Steel (S-7)	Oct 95	101	40
1776	Naval Brass WK1	Jul 95	102	48
1777	Naval Brass WK2	Jul 95	102	48
1778	Naval Brass WK3	Jul 95	102	48
1779	Naval Brass WK4	Jul 95	102	48
1780	Naval Brass WK5	Jul 95	102	48
1781	Free-Cutting Brass WN1	In Prep	102	48
1782	Free-Cutting Brass WN2	In Prep	102	48
1783	Free-Cutting Brass WN3	In Prep	102	48
1784	Free-Cutting Brass WN4	In Prep	102	48
1785	Free-Cutting Brass WN5	In Prep	102	48

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1786	Cartridge Brass MH1	In Prep	102	48
1787	Cartridge Brass MH2	In Prep	102	48
1788	Cartridge Brass MH3	In Prep	102	48
1789	Cartridge Brass MH4	In Prep	102	48
1790	Cartridge Brass MH5	In Prep	102	48
1791	Gilding Metal M11	In Prep	102	49
1792	Gilding Metal M12	In Prep	102	49
1793	Gilding Metal M13	In Prep	102	49
1794	Gilding Metal M14	In Prep	102	49
1795	Gilding Metal M15	In Prep	102	49
1800	Organic Compounds/N2 (large)	Dec 93	107	71
1800a	Organic Compounds/N2 (small)	Aug 97	107	71
1804a	Tox. Organic Compounds/N2	Nov 92	107	71
1810a	Linerboard	May 97	309	132
1811	Aromatic Organics/N2	Discontinued		
1812	Aromatic Organics/N2	Discontinued		
1815a	n-Heptane (Fuel Rating)	Mar 85	108	73
1816a	Isooctane (Fuel Rating)	Mar 85	108	73
1817c	Catalyst Package IIID	Jun 92	114	96
1818a	Chlorine in Lub. Base Oil	Apr 94	114	95
1819a	Sulfur in Lub. Base Oil	Apr 94	114	95
1820	Borosilicate Glass (Refractive Index)	Sep 74	209	122
1822	Soda-Lime Glass (Refractive Index)	Discontinued		
1826a	Soda-Lime Glass (Density)	Feb 96	209	122
1827a	Lead Silica Glass (Density)	Feb 96	209	122
1828a	Ethanol-Water Soln.	Jun 96	105	64
1829	Alcohols in Ref. Fuels	Mar 86	108	72
1830	Soda Lime Float (Glass)	Apr 97	112	91
1831	Soda Lime Sheet (Glass)	Apr 97	112	91
1832	Thin Glass Film (XRF)	Discontinued		
1833	Thin Glass Film (XRF)	Out of Stock		68
1834	Fused Ore (Glass)	Jul 90	112	91
1835	Borate Ore	Sep 87	111	86
1836	Nitrogen in Lub. Base Oil	Dec 89	114	95
1837	Methanol, Butanol (Fossil Fuel)	Mar 86	108	72
1838	Ethanol (Fossil Fuel)	Mar 86	108	72
1839	Methanol (Fossil Fuel)	Mar 86	108	72
1842	X-Ray Stage Calib., X and Y Dimen.	Nov 93	209	123
1843	X-Ray Stage Calib., Z Dimen.	Nov 93	209	123
1845	Cholesterol in Egg Powder	Apr 94	110	80
1846	Infant Formula (milk-based)	May 96	110	80
1850	Penetrant Test Block	Aug 97	303	130
1851	Penetrant Test Block	Apr 84	303	130
1853	Magnetic Particle Test Ring	Apr 92	303	130
1857	Tool Steel (Abrasive Wear)	Mar 83	302	129
1866a	Common Commercial Asbestos	Jun 91	105	67
1867	Uncommon Commercial Asbestos	Aug 93	105	67
1868	Asbestos in Building Materialsk	In Prep	105	67
1872	Synthetic Glass	May 84	103	53
1873	Synthetic Glass	May 84	103	53
1876b	Chrysotile Asbestos	Jan 92	105	67
1878a	Respirable α-Quartz	In Prep	105/209	66/123
1879a	Respirable Cristobalite	In Prep	105	66
1880	Portland Cement, Black	Jan 93	113	93
1881	Portland Cement, White	Jan 89	113	93
1882	Portland Cement, Orange	Jul 90	113	93
1883	Portland Cement, Silver	Jul 90	113	93
1884	Portland Cement, Ivory	Sep 89	113	93
1885	Portland Cement, Turquoise	Sep 89	113	93
1886	Portland Cement, Cranberry	Sep 89	113	93
1887	Portland Cement, Brown	Sep 89	113	93
1888	Portland Cement, Purple	Sep 89	113	93
1889	Portland Cement, Gray	Sep 89	113	93
1893	Microhardness, Cu-Knoop	Mar 95	302	129
1894	Microhardness, Cu-Vickers	Nov 94	302	129
1895	Microhardness, Ni-Knoop	Mar 95	302	129
1896	Microhardness, Ni-Vickers	Mar 95	302	129
1899	Specific Surface Area (BET)	Jun 97	301	128
1900	Specific Surface Area (BET)	In Prep	301	128
1905	Microhardness, Ni-Knoop	Mar 92	302	129
1906	Microhardness, Ni-Knoop	Nov 94	302	129
1907	Microhardness, Ni-Knoop	Mar 95	302	129
1920a	Near IR Reflectance	In Prep	204	111
1921	IR Transmission Wavelength	Jun 97	204	108/110
1923	Poly(ethylene oxide)	Jun 94	202	101
1924	Poly(ethylene oxide)	Jun 94	202	101
1930	Glass Filters, Transmittance	Aug 94	204	109/110
1931	Fluorescence Spectra	Discontinued		
1939a	PCBs in River Sediment A	Oct 90	109	75
1941a	Organics in Marine Sediment	Mar 94	109	75
1944	NY/NJ Waterway Sediment	In Prep	109	75
1945	Organics in Whale Blubber	Jun 94	109	75
1951a	Cholesterol in Human Serum	Jun 97	105	62/63
1952a	Cholesterol in Human Serum	Jan 90	105	62
1960	Polystyrene (Particle Size)	Apr 85	301	127
1961	Polystyrene (Particle Size)	Jan 87	301	127
1963	Polystyrene (Particle Size)	Nov 93	301	127
1965	Polystyrene (on Slide)(Particle Size)	Jan 87	301	127
1967	Platinum Thermoelement Material	Jul 90	203	106
1968	Gallium (Melting Point)	Mar 91	203	105
1969	Rubidium (Triple Point)	Mar 91	203	105
1970	Succinonitrile (Triple Point)	Apr 91	203	105
1971	Indium (Freezing Point)	Aug 90	203	105
1972	1,3-Dioxolan-2-one (Triple Point)	May 94	203	105
1973	n-Docosane (Triple Point)	May 93	203	105
1974a	Organics in Mussel Tissue	Jul 97	109	75
1976	Instrument Intensity, Alumina (XRD)	Nov 91	209	123
1978	Zirconium Oxide (Particle Size)	Oct 93	301	127
1980	Electrophoretic Mobility (Positive)	Mar 94	301	128
1982	Thermal Spray Zirconia (Particle Size)	Nov 96	301	127
1990	Ruby Sphere (XRD)	In Prep	209	123
2003	First Surface Aluminum on Glass	Mar 96	204	110
2011	First Surface, Gold on Aluminum	May 92	204	110
2015	Opal Glass (Reflectance)	May 82	204	111
2023	Second Surface, Aluminum on Quartz	Sep 92	204	110
2026	First Surface, Black Glass	Oct 92	204	110
2030a	Glass Filters, Transmittance	Oct 93	204	109/110
2031a	Metal-on-Quartz Filters, Transmittance	Jul 97	204	109/110
2032	Potassium Iodide,Stray Light	Oct 79	204	109/110
2034	Holmium Oxide Wavelength	Jul 96	204	109/110
2063a	Mineral Glass (Thin Film)	Feb 93	103	53
2069b	SEM Performance	May 91	207	118
2071b	Sinusoidal Roughness	In Prep	302	129
2073a	Sinusoidal Roughness	Oct 95	302	129
2074	Sinusoidal Roughness	Jun 92	302	129
2075	Sinusoidal Roughness	Jan 94	302	129
2083	Socketed Ball Bar	Aug 85	309	132
2084	CMM Probe Performance	Oct 96	309	132
2084R	CMM Probe (10-mm sphere)	Jun 96	309	132
2085	CMM Probe (25-mm sphere)	Jun 96	309	132
2090	SEM Magnification	In Prep	207	118
2092	Low Energy Charpy	Feb 97	309	132
2096	High Energy Charpy	Feb 97	309	132
2098	Super High Energy Charpy	Feb 97	309	132
2108	Chromium (III) Speciation	In Prep	104	60
2109	Chromium (VI) Speciation	Aug 95	104	60
2134	Arsenic Depth Profile	In Prep	207	118
2135c	Nickel-Chromium Depth Profile	In Prep	207	118
2136	Chromium/Chromium Oxide Depth Profile	Mar 91	207	118
2137	Boron Implant in Silicon Depth Profile	Apr 93	207	118
2141	Urea	Aug 70	104	56
2142	0-Bromobenzoic Acid	Sep 70	104	56
2143	p-Fluorobenzoic Acid	Jan 82	104	56
2144	m-Chlorobenzoic Acid	Apr 73	104	56
2151	Nicotinic Acid (Comb. Calorimetry)	Jan 85	203	103
2152	Urea (Comb. Calorimetry)	Jan 85	203	103
2159	LA Steel, Carbon & Sulfur only	Mar 90	101	33
2160	LA Steel, Carbon & Sulfur only	Mar 90	101	33
2165	LA Steel, E	Jun 89	101	33
2166	LA Steel, F	Jun 89	101	33
2167	LA Steel, G	Jun 89	101	33

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2168	High Purity Iron	Dec 91	101	33
2171	LA Steel, (HSLA 100)	Oct 91	101	32
2172	S-7 Tool Steel	Dec 96	101	35
2181	HEPES Free Acid	Mar 92	201	99
2182	HEPES ate	Mar 92	201	99
2183	MOPSO Free Acid	Mar 92	201	99
2184	MOPSO Bte	Mar 92	201	99
2185	Pot. Hydrogen Phthalate	Nov 84	201	99
2186I	Pot. Dihydro. Phosphate	May 68	201	99
2186II	Disod. Hydro. Phosphate	May 68	201	99
2191a	Sodium Bicarbonate	Feb 94	201	99
2192a	Sodium Carbonate	Feb 94	201	99
2193	Calcium Carbonate	Oct 91	201	99
2201	Sodium Chloride (Ion-Selective)	May 93	201	100
2202	Potassium Chloride (Ion-Selective)	Mar 84	201	100
2203	Potassium Fluoride (Ion-Selective)	May 73	201	100
2220	Tin (Dif. Scan. Calor.)	May 89	203	104
2221b	Zinc (Dif. Scan. Calor.)	In Prep	203	104
2222	Biphenyl (Dif. Scan. Calor.)	Jun 89	203	104
2225	Mercury (Dif. Scan Calor.)	Mar 89	203	104
2260	Aromatic Hydrocarbons in Toluene	Jun 91	109	75
2261	Chlorinated Pesticides in Hexane	Jan 92	109	75
2262	Chlorinated Biphenyls in Isooctane	Mar 95	109	75
2286	Ethanol in Gasoline	Feb 95	108	72
2287	Ethanol in Gasoline	Jan 95	108	72
2288	t-Amyl Methyl Ether in Gas.	Jan 95	108	72
2289	t-Amyl Methyl Ether in Gas.	Jan 95	108	72
2290	Ethyl t-Butyl Ether in Gas.	Jan 95	108	72
2291	Ethyl t-Butyl Ether in Gas.	Jan 95	108	72
2292	Methyl t-Butyl Ether in Gas.	Jan 95	108	72
2293	Methyl t-Butyl Ether in Gas.	Feb 95	108	72
2294	Reform. Gas. (nom. 11 % MTBE)	In Prep	108	72
2295	Reform. Gas. (nom. 15 % MTBE)	In Prep	108	72
2296	Reform. Gas. (nom. 13 % ETBE)	In Prep	108	72
2297	Reform. Gas. (nom. 10 % Ethanol)	In Prep	108	72
2321	Sn-Pb Alloy Coating	Jun 91	207	119
2350	Nickel Step Test	Aug 85	302	129
2381	Morphine and Codeine in Urine	Jul 93	105	65
2382	Morphine Glucuronide in Urine	Jul 93	105	64
2383	Baby Food Composite	In Prep	110	80
2389	Amino Acids in Hydrochloric Acid	Dec 93	105	62
2390	DNA Profiling	Aug 92	105	65
2391	PCR-Based DNA Profiling	May 95	105	65
C2400	HA Steel ACI (17/4 PH)	Feb 86	101	39
C2401	HA Steel (ACI-C-4M-Cu)	Feb 86	101	39
C2402	Hastelloy™ C	Feb 86	101	50
C2415	Battery Lead	Mar 91	102	49
C2416	Bullet Lead	Feb 88	102	49
C2417	Lead-Base Alloy	Feb 87	102	49
C2418	High Purity Lead	Feb 87	102	49
C2423	Ductile Iron A	Nov 85	101	43
C2423a	Ductile Iron B	Nov 85	101	43
C2424	Ductile Iron C	Jul 85	101	43
C2424a	Ductile Iron D	Jul 85	101	43
2430	Scheelite Ore	Jan 87	111	84
2431	Titanium Base Alloy	Aug 93	102	51
2432	Titanium Base Alloy	Aug 93	102	51
2433	Titanium Base Alloy	Apr 96	102	51
2517	Wavelength Reference Absorption	Oct 97	207	119
2518	Polarization Mode Dispersion	In Prep	207	119
2519	Wavelength Reference Absorption	In Prep	207	119
2520	Optical Fiber Diameter	Jan 96	207	119
2521	Optical Fiber Coating	In Prep	207	119
2522	Pin Gauge for Opt. Fib. Ferrules	May 96	207	119
2523	Optical Fiber Ferrule Geometry	Aug 97	207	119
2524	Optical Fiber Chromatic Dispersion	Feb 97	207	119
2525	Optical Retardance	Apr 97	207	119
2526	111P-Type Si. Sprd. Resist.	Aug 83	206	117
2527	111N-Type Si. Sprd. Resist.	Aug 83	206	117
2528	100P-Type Si. Sprd. Resist.	Jan 84	206	117
2529	100N-Type Si. Sprd. Resist.	May 84	206	117
2531	Si/SiO2 Thickness-50 nm	Jul 92	207	120
2532	Si/SiO2 Thickness-100 nm	Jul 92	207	120
2533	Si/SiO2 Thickness-200 nm	Jul 92	207	120
2534	Si/SiO2 Thickness-25 nm	Jul 92	207	120
2535	Si/SiO2 Thickness-14 nm	Sep 94	207	120
2536	Si/SiO2 Thickness-10 nm	Sep 94	207	120
2541	Silicon Resistivity	In Prep	206	117
2542	Silicon Resistivity	In Prep	206	117
2543	Silicon Resistivity	In Prep	206	117
2544	Silicon Resistivity	Aug 97	206	117
2545	Silicon Resistivity	Sep 96	206	117
2546	Silicon Resistivity	In Prep	206	117
2547	Silicon Resistivity	In Prep	206	117
2551	Oxygen in Silicon	Mar 94	207	120
2556	Recycled Pellet (Autocatalyst)	Aug 93	106	69
2557	Recycled Monolith (Autocatalyst)	Aug 93	106	69
2567	Catalyst Package 111E	Jul 95	114	96
2570	Lead Paint Film, Blank	In Prep	105	67
2571	Lead Paint Film, Nom. 3.5 mg/cm^2	In Prep	105	67
2572	Lead Paint Film, Nom. 1.6 mg/cm^2	In Prep	105	67
2573	Lead Paint Film, Nom. 1.0 mg/cm^2	In Prep	105	67
2574	Lead Paint Film, Nom. 0.7 mg/cm^2	In Prep	105	67
2575	Lead Paint Film, Nom. 0.3 mg/cm^2	In Prep	105	67
2576	Lead Paint Film, High Level	In Prep	105	67
2579a	Lead Paint Films	Mar 93	105	67
2580	Powdered Paint, Nom. 4 % Pb	Dec 96	105	67
2581	Powdered Paint, Nom. 0.5 % Pb	Jan 97	105	67
2582	Powdered Paint, (Low Lead)	Jun 97	105	67
2583	Trace El. in Indoor Dust	Dec 96	105/106	67/68
2584	Trace El. in Indoor Dust	In Prep	105	67
2586	Trace El. in Soil containing Lead	In Prep	105	67
2587	Trace El. in Soil containing Lead	In Prep	105	67
2589	Powdered Paint, Nom. 10 % Pb	Jun 97	105	67
2607	CO2/N2O/Air, 340/0.3 µmol/mol	Discontinued		
2609	CO2/N2O/Air, 380/0.33 µmol/mol	Discontinued		
2610	CO2/N2O/Air, 380/0.33 µmol/mol	Discontinued		
2612a	CO/Air, 10 µmol/mol	Jun 97	107	70
2613a	CO/Air, 20 µmol/mol	Nov 95	107	70
2614a	CO/Air, 45 µmol/mol	Nov 95	107	70
2619a	CO2/N2, 0.5 mol %	Jun 97	107	70
2620a	CO2/N2, 1.0 mol %	Jun 97	107	70
2621a	CO2/N2, 1.5 mol %	Aug 97	107	70
2622a	CO2/N2, 2.0 mol %	Nov 95	107	70
2623a	CO2/N2, 2.5 mol %	Jun 92	107	70
2624a	CO2/N2, 3.0 mol %	Jul 96	107	70
2625a	CO2/N2, 3.5 mol %	Aug 94	107	70
2626a	CO2/N2, 4.0 mol %	Apr 95	107	70
2627a	NO/N2, 5 µmol/mol	Dec 95	107	71
2628a	NO/N2, 10 µmol/mol	Jul 95	107	71
2629a	NO/N2, 20 µmol/mol	Aug 97	107	71
2630	NO/N2, 1500 µmol/mol	Apr 97	107	71
2631a	NO/N2, 3,000 µmol/mol	In Prep	107	71
2632a	CO2/N2, 300 µmol/mol	Discontinued		
2635a	CO/N2, 25 µmol/mol	Jun 97	107	70
2636a	CO/N2, 250 µmol/mol	May 97	107	70
2637a	CO/N2, 2500 µmol/mol	May 97	107	70
2638a	CO/N2, 5000 µmol/mol	May 97	107	70
2639a	CO/N2, 1 mol %	Sep 97	107	70
2640a	CO/N2, 2 mol %	Sep 97	107	70
2641a	CO/N2, 4 mol %	Oct 97	107	70
2642a	CO/N2, 8 mol %	Sep 93	107	70
2643a	C3H8/N2, 100 µmol/mol	In Prep	107	71
2644a	C3H8/N2, 250 µmol/mol	In Prep	107	71
2645a	C3H8/N2, 500 µmol/mol	In Prep	107	71
2646a	C3H8/N2, 1000 µmol/mol	In Prep	107	71
2647a	C3H8/N2, 2500 µmol/mol	In Prep	107	71
2648a	C3H8/N2 5000 µmol/mol	In Prep	107	71
2649a	C3H8/N2, 1 mol %	In Prep	107	71
2650	C3H8/N2, 2 mol %	In Prep	107	71
2651	C3H8/N2 & O2, 0.01/5 mol %	Discontinued		
2652	C3H8/N2 & O2, 0.01/10 mol %	Discontinued		
2656	NOx/Air, 2500 µmol/mol	In Prep	107	71
2657a	O2/N2, 2 mol %	Jun 93	107	71
2658a	O2/N2, 10 mol %	In Prep	107	71
2659a	O2/N2, 21 mol %	In Prep	107	71

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2660	NOx/Air, 100 µmol/mol	In Prep	107	71
2670	Toxic Metals in Urine	Aug 94	105	64
2671a	Fluorine in Urine	Aug 95	105	64
2672a	Mercury in Urine	May 83	105	64
2676d	Metals on Filter Media	Aug 92	105	66
2677a	Be and As on Filter Media	Feb 94	105	66
2678	Membrane Blank Filter	May 88	105	66
2679a	Quartz on Filter Media	May 84	105	66
2681	Ashless Blank Filter	May 88	105	66
2682a	Sulfur in Coal, 0.5%, (also Heat of Comb.)	May 94	108	73
2683b	Sulfur in Coal, 2%, (also Heat of Comb.)	Oct 97	108/203	73/103
2684a	Sulfur in Coal, 3%, (also Heat of Comb.)	Nov 92	108/203	73/103
2685a	Sulfur in Coal, 5%, (also Heat of Comb.)	May 94	108	73
2689	Coal Fly Ash	Dec 93	108	74
2690	Coal Fly Ash	Dec 93	108	74
2691	Coal Fly Ash	Dec 93	108	74
2692a	Sulfur in Coal, 1%	Sep 94	108/203	73/103
2694b	Simulated Rainwater	In Prep	106	68
2695	Fluoride in Vegetation	Aug 91	110	82
2704a	Buffalo River Sediment	In Prep	106/111	68/89
2709	San Joaquin Soil	Aug 93	106/111	68/89
2710	Montana I Soil	Oct 97	106/111	68/89
2711	Montana II Soil	Aug 93	106/111	68/89
2712	Lead in Ref. Fuel	Sep 88	108	72
2713	Lead in Ref. Fuel	Sep 88	108	72
2714	Lead in Ref. Fuel	Sep 88	108	72
2715	Lead in Ref. Fuel	Sep 88	108	72
2717	Sulfur in Residual Fuel Oil	Oct 90	108	73
2718	Trace El. in Green Petroleum Coke	In Prep	108	73/74
2719	Trace El. in Calcined Petroleum Coke	In Prep	108	73/74
2723	Sulfur in Diesel Fuel Oil	In Prep	108	73
2724a	Sulfur in Diesel Fuel Oil, 0.04%	Aug 95	108	73
2727	IM Gases, 3 Components	Discontinued		
2728	IM Gases, 3 Components	Discontinued		
2730	H2S/N2, 5 µmol/mol	Apr 95	107	71
2731	H2S/N2, 20 µmol/mol	In Prep	107	71
2735	NO/N2, 800 µmol/mol	In Prep	107	71
2736	NO/N2, 2000 µmol/mol	Sep 90	107	71
2740	CO/N2, 10 mol %	Sep 90	107	70
2741	CO/N2, 13 mol %	Sep 90	107	70
2745	CO2/N2, 16 mol %	Jul 96	107	70
2750	CH4/Air, 50 µmol/mol	May 97	107	71
2751	CH4/Air, 100 µmol/mol	May 97	107	71
2764	C3H8/Air, 0.25 µmol/mol	Nov 95	107	71
2775	Foundry Coke	May 97	108	73
2776	Furnace Coke	In Prep	108	73
2781	Domestic Sludge	Oct 96	106/111	68/89
2782	Industrial Sludge	In Prep	106/111	68/89
2798	Microhardness, Ni Vickers	Aug 93	302	129
2806	Medium Test Dust in Hydraulic Fluid	Dec 97	301	128
2830	Microhardness, Ceramic-Knoop	Feb 96	302	129
2831	Microhardness, Ceramic-Vickers	In Prep	302	129
2910	Calcium Hydroxyapatite	Nov 97	105/209	65/123
2974	Organics in Freeze-Dried Mussel Tissue	Jul 97	109	75
2975	Diesel Particulate Matter	In Prep	109	75
3087a	Metals on Filter Media	Jan 97	105	66
3101a	Aluminum Standard Soln.	May 96	104	57
3102a	Antimony Standard Soln.	Apr 97	104	57
3103a	Arsenic Standard Soln.	Mar 97	104	57
3104a	Barium Standard Soln.	Sep 97	104	57
3105a	Beryllium Standard Soln.	Oct 96	104	57
3106	Bismuth Standard Soln.	Aug 96	104	57
3107	Boron Standard Soln.	Jan 97	104	57
3108	Cadmium Standard Soln.	Jan 97	104	57
3109a	Calcium Standard Soln.	Nov 96	104	57
3110	Cerium Standard Soln.	Feb 95	104	57
3111a	Cesium Standard Soln.	Feb 95	104	57
3112a	Chromium Standard Soln.	Oct 96	104	57
3113	Cobalt Standard Soln.	May 96	104	57
3114	Copper Standard Soln.	Apr 97	104	57

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3115a	Dysprosium Standard Soln.	Apr 96	104	57
3116a	Erbium Standard Soln.	Sep 96	104	57
3117a	Europium Standard Soln.	Oct 96	104	57
3118a	Gadolinium Standard Soln.	Jul 96	104	57
3119a	Gallium Standard Soln.	Jun 96	104	57
3120	Germanium Standard Soln.	Mar 97	104	57
3121	Gold Standard Soln.	Mar 97	104	57
3122	Hafnium Standard Soln.	Jan 96	104	57
3123a	Holmium Standard Soln.	Aug 95	104	57
3124a	Indium Standard Soln.	Jan 97	104	57
3126a	Iron Standard Soln.	Mar 96	104	57
3127a	Lanthanum Standard Soln.	Jul 96	104	57
3128	Lead Standard Soln.	May 97	104	57
3129a	Lithium Standard Soln.	Feb 96	104	57
3130a	Lutetium Standard Soln.	Jul 95	104	57
3131a	Magnesium Standard Soln.	Jan 97	104	57
3132	Manganese Standard Soln.	Oct 95	104	57
3133	Mercury Standard Soln.	Jan 97	104	57
3134	Molybdenum Standard Soln.	May 96	104	57
3135a	Neodymium Standard Soln.	Feb 96	104	57
3136	Nickel Standard Soln.	Jan 97	104	57
3137	Niobium Standard Soln.	Mar 97	104	57
3138	Palladium Standard Soln.	Dec 96	104	57
3139a	Phosphorus Standard Soln.	Aug 96	104	57
3140	Platinum Standard Soln.	Nov 97	104	57
3141a	Potassium Standard Soln.	Mar 97	104	57
3142a	Praseodymium Standard Soln.	Feb 96	104	57
3143	Rhenium Standard Soln.	Mar 97	104	57
3144	Rhodium Standard Soln.	Aug 95	104	57
3145a	Rubidium Standard Soln.	Aug 95	104	57
3147a	Samarium Standard Soln.	Aug 95	104	58
3148a	Scandium Standard Soln.	Jul 95	104	58
3149	Selenium Standard Soln.	Apr 97	104	58
3150	Silicon Standard Soln.	May 97	104	58
3151	Silver Standard Soln.	May 96	104	58
3152a	Sodium Standard Soln.	May 97	104	58
3153a	Strontium Standard Soln.	Jan 97	104	58
3154	Sulfur Standard Soln.	Nov 95	104	58
3155	Tantalum Standard Soln.	Mar 96	104	58
3156	Tellurium Standard Soln.	May 95	104	58
3157a	Terbium Standard Soln.	Aug 95	104	58
3158	Thallium Standard Soln.	May 97	104	58
3159	Thorium Standard Soln.	Oct 96	104	58
3160a	Thulium Standard Soln.	Jul 95	104	58
3161a	Tin Standard Soln.	Feb 97	104	58
3162a	Titanium Standard Soln.	Mar 97	104	58
3163	Tungsten Standard Soln.	May 97	104	58
3164	Uranium Standard Soln.	Mar 97	104	58
3165	Vanadium Standard Soln.	Apr 97	104	58
3166a	Ytterbium Standard Soln.	Jul 95	104	58
3167a	Yttrium Standard Soln.	Aug 95	104	58
3168a	Zinc Standard Soln.	Jun 96	104	58
3169	Zirconium Standard Soln.	Jul 97	104	58
3171a	Multielement Mix A1 Standard Soln.	In Prep	104	58
3172a	Multielement Mix B1 Standard Soln.	Apr 96	104	59
3179	Multielement Mixes I, II, III Standard Solns.	Sep 97	104	59
3181	Sulfate Anion Soln.	Sep 97	104	60
3182	Chloride Anion Soln.	Aug 97	104	60
3183	Fluoride Anion Soln.	Aug 97	104	60
3184	Bromide Anion Soln.	Dec 97	104	60
3185	Nitrate Anion Soln.	Oct 96	104	60
3186	Phosphate Anion Soln.	Oct 97	104	60
3190	Electro. Conductivity (25 µS/cm)	Feb 97	201	100
3191	Electro. Conductivity (100 µS/cm)	Sep 97	201	100
3192	Electro. Conductivity (500 µS/cm)	Apr 97	201	100
3193	Electro. Conductivity (1000 µS/cm)	Sep 97	201	100
3194	Electro. Conductivity (10,000 µS/cm)	In Prep	201	100
3195	Electro. Conductivity (100,000 µS/cm)	Apr 97	201	100
3196	Electro. Conductivity (20,000 µS/cm)	In Prep	201	100
3198	Electro. Conductivity (5 µS/cm)	Apr 97	201	100

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3199	Electro. Conductivity (15 µS/cm)	In Prep	201	100
4200B	Cesium/Barium-137m	Dec 79	205	115
4201B	Niobium-94	Jun 70	205	115
4203D	Cobalt-60	Jun 95	205	115
4207B	Cesium-137/Barium-137m	Mar 87	205	115
4222C	Carbon-14 (as hexadene)	Jan 91	205	113
4226C	Nickel-63 Soln.	Dec 95	205	113
4233D	Cesium-137 Soln.	Jul 96	205	113
4234A	Strontium-90 Soln.	May 95	205	113
4241C	Barium-133	In Prep	205	115
4251C	Barium-133 Soln.	Oct 94	205	113
4275C	Mixed Radionuclide	Sep 88	205	115
4276C	Mixed Radionuclide Soln.	Sep 88	205	113
4288A	Technetium-99 Soln.	Oct 96	205	113
4320A	Curium-244 Soln.	Feb 96	205	113
4321B	Natural Uranium Soln.	Feb 92	205	113
4322B	Americium-241 Soln.	Oct 91	205	113
4323A	Plutonium-238 Soln.	Feb 95	205	113
4324A	Uranium-232 Soln.	Jun 95	205	113
4325	Beryllium-10/Beryllium-9	May 90	205	115
4326	Polonium-209 Soln.	Jan 95	205	113
4328B	Thorium-229 Soln.	Jul 96	205	113
4329	Curium-243 Soln.	Mar 85	205	113
4330A	Plutonium-239 Soln.	Jan 96	205	113
4332D	Americium-243 Soln.	Sep 95	205	113
4334F	Plutonium-242 Soln.	Mar 96	205	113
4338A	Plutonium-240 Soln.	Aug 96	205	113
4339A	Radium-228 Soln	Aug 95	205	113
4340A	Plutonium-241 Soln.	May 96	205	113
4341	Neptunium-237 Soln.	Jan 93	205	113
4350B	River Sediment (Radioactivity)	Sep 81	205	116
4351	Human Lung (Radioactivity)	Oct 82	205	116
4352	Human Liver (Radioactivity)	Jun 82	205	116
4353A	Rocky Flats Soil No. II (Radioactivity)	In Prep	205	116
4354	Lake Sediment (Radioactivity)	Feb 86	205	116
4355	Peruvian Soil (Radioactivity)	Jun 82	205	116
4356	Ashed Bone (Radioactivity)	In Prep	205	116
4357	Ocean Sediment (Radioactivity)	Mar 97	205	116
4358	Ocean Shellfish (Radioactivity)	In Prep	205	116
4361C	Hydrogen-3 Soln.	In Prep	205	113
4370C	Europium-152 Soln.	Mar 87	205	113
4400N	Chromium-51 Soln.	Discontinued		
4401W	Iodine-131 Soln.	FC	205	114
4402C	Tin-113/Indium-113m Soln.	Discontinued		
4403B	Strontium-85 Soln.	Discontinued		
4404S	Thallium-201 Soln.	FC	205	114
4405B	Gold-198 Soln.	Discontinued		
4406O	Phosphorus-32 Soln.	FC	205	114
4407U	Iodine-125 Soln.	FC	205	114
4408F	Cobalt-57 Soln.	FC	205	114
4409D	Selenium-75 Soln.	Discontinued		
4410V	Technetium-99m Soln.	FC	205	114
4411B	Iron-59 Soln.	Discontinued		
4412V	Molybdenum-99/Technetium-99 Soln.	FC	205	114
4414C	Iodine-123 Soln.	Discontinued		
4415U	Xenon-133 Gas	FC	205	114
4416Q	Gallium-67 Soln.	FC	205	114
4417Q	Indium-111 Soln.	FC	205	114
4418A	Mercury-203 Soln.	Discontinued		
4419C	Ytterbium-169 Soln.	Discontinued		
4420B	Lead-203 Soln.	Discontinued		
4421A	Gold-195 Soln.	Discontinued		
4424A	Sulfur-35 Soln.	Discontinued		
4425B	Samarium-153 Soln.	FC	205	114
4426A	Strontium-89 Soln.	FC	205	114
4427B	Yttrium-90 Soln.	FC	205	114
4904NG	Americium-241	Discontinued		
4904SG	Americium-241	Discontinued		
4906C	Plutonium-238	Nov 87	205	114
4906HC	Plutonium-238	Nov 87	205	114
4915E	Cobalt-60 Soln.	Feb 84	205	113
4919H	Strontium-90 Soln.	May 88	205	113
4926D	Hydrogen-3 Water Soln.	Aug 89	205	113
4927E	Hydrogen-3 Soln.	Jan 89	205	113
4929D	Iron-55 Soln.	Feb 86	205	113
4943	Chlorine-36 Soln.	Dec 84	205	113
4947C	Hydrogen-3 Toluene Soln.	May 87	205	113
4949C	Iodine-129 Soln.	Feb 82	205	113
4952C	Radium-226 Blank Soln.	Jan 92	205	113
4965	Radium-226 Soln.	Jan 92	205	113
4966	Radium-226 Soln.	Jan 92	205	113
4967	Radium-226 Soln.	Jan 92	205	113
4968	Radium-226/Radon-222 Eman.	Aug 94	205	115
4990C	Oxalic Acid (C-14 Dating)	Jul 83	205	114
8030	BCR No 60 Aquatic Plant	Jun 82	110	82
8031	BCR No 61 Aquatic Mass	Jun 82	110	82
8036	BCR No 150 Spiked Skim Milk	Dec 85	110	80
8050-8052	RCM Fine Gold	Aug 95	104	54/55
8053-8055	RCM Fine Gold	Oct 95	104	54/55
8056-8058	RCM Fine Gold	Oct 95	104	54/55
8059-8061	RCM Fine Gold	Oct 95	104	54/55
8062-8064	RCM Fine Gold	Oct 95	104	54/55
8065-8067	RCM Fine Gold	Sep 95	104	54/55
8068-8070	RCM Gold Bullion	Oct 95	104	54/55
8071-8073	RCM Gold Bullion	Oct 95	104	54/55
8074-8076	RCM Gold Bullion	Oct 95	104	54/55
8077-8079	RCM Gold Bullion	Oct 95	104	54/55
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8090	SEM Magnification Calibration	Aug 95	207	118
8101a	Auto. Computer Time Service	Discontinued		
8162	RCM Fine Silver	Oct 95	104	54/55
8165	RCM Fine Silver	Oct 95	104	54/55
8168	RCM Fine Silver	Sep 95	104	54/55
8171	RCM Fine Silver	Oct 95	104	54/55
8384	TBBS (powder)	Discontinued		
8406	Tennessee River Sediment	Discontinued		
8407	Tennessee River Sediment	Jun 90	106/111	68/89
8411	Mixed Asbestos Research Filter	Nov 88	105	67
8412	Corn Stalk (Zea Mays)	Sep 93	110	80/182
8413	Corn Kernel (Zea Mays)	Sep 93	110	80/182
8414	Bovine Muscle Powder (Beef)	Sep 93	110	80
8415	Whole Egg Powder	Sep 93	110	80
8416	Micro. Cellulose	Sep 93	110	80
8418	Wheat Gluten	Sep 93	110	80
8420	Electrolytic Iron	May 84	203/206	107/117
8421	Electrolytic Iron	May 84	203/206	107/117
8424	Graphite	May 84	203	107
8425	Graphite	May 84	203	107
8426	Graphite	May 84	203	107
8432	Corn Starch	Sep 93	110	81
8433	Corn Bran	Sep 93	110	81
8435	Whole Milk Powder	Sep 93	110	80/81
8436	Durum Wheat Flour	Sep 93	110	81
8437	Hard Red Spring Wheat Flour	Sep 93	110	81
8438	Soft Winter Wheat Flour	Sep 93	110	81
8441	Wheat Hardness	Dec 97	110	83
8442	LC Selectivity	Discontinued		
8443	GC/MS System Performance	Aug 84	109	75
8444	Cotinine in Freeze-dried Urine	Feb 89	105	64
8448	Drugs of Abuse in Hair Segments	Mar 92	105	65
8449	Drugs of Abuse in Powdered Hair	Feb 92	105	65
8450	Polyethylene Piping, 1.3 cm	Jan 88	202	102
8451	Polyethylene Piping, 4.8 cm	Jan 88	202	102
8452	Polyethylene Piping, 10.2 cm	Jan 88	202	102
8453	Poly Socket T Joint	Jan 88	202	102
8454	Poly Butt T Joint	Jan 88	202	102
8455	Pyrite Ore	Apr 91	111	86
8458	Artificial Flaw for Eddy Current NDF	Aug 91	303	130
8466	Y-HCH (Lindane) (neat)	Apr 92	109	75
8467	4,4'-DDE (neat)	Apr 92	109	75
8469	Pesticide, 4,4'-DDT (neat)	Apr 92	109	75
8486	Portland Cement Clinker	May 89	113	94
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8496	Eucalyptus Hardwood	N/A	209	133
8501	Catalyst Package IIIE	Jul 91	114	96
8505	Vanadium in Crude Oil	Oct 83	108	72
8506	Moisture in Transformer Oil	Jun 97	108	73
8507	Moisture in Mineral Oil	Jun 97	108	73
8509	Moisture in Methanol, 93 mg/kg	Jun 97	108	73
8510	Moisture in Methanol, 325 mg/kg	Jun 97	108	73
8517	N-Decane Flashpoint	Oct 95	203	103
8518	N-Undecane Flashpoint	Oct 95	203	103
8519	N-Tetradecane Flashpoint	Oct 95	203	103
8520	N-Hexadecane Flashpoint	Oct 95	203	103
8535	VSMOW-Water	Oct 92	104	61
8536	GISP-Water	Oct 92	104	61
8537	SLAP-Water	Oct 92	104	61
8538	NBS30-Biotite	Jun 92	104	61
8539	NBS22-Oil	Jun 92	104	61
8540	PEFI-Polyethylene Foil	Jun 92	104	61
8541	USGS24-Graphite	Jun 92	104	61
8542	Sucrose ANU-Sucrose	Jun 92	104	61
8543	NBS18-Carbonatite	Jun 92	104	61
8544	NBS19-Limestone	Jun 92	104	61
8545	LSVEC-Lithium Carbonate	Jun 92	104	61
8546	NBS28-Silica Sand	Jun 92	104	61
8547	IAEAN1-Ammonium Sulfate	Feb 93	104	61
8548	IAEAN2-Ammonium Sulfate	Feb 93	104	61
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8553	Soufre De Lacq-Elemen.-Sulf.	Jun 92	104	61
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8558	USGS32-Potassium Nitrate	Feb 93	104	61
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8758	ICTAC Set DTA		Discontinued	
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N/A - Certificate does not exist.

FC - New certificate is issued with each new sublot prepared.

In Prep - New or Renewal SRM being prepared.

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Numerical MSDS Index

Numerical MSDS Index

The following is a listing of Material Safety Data Sheets (MSDSs) for compounds that have been determined to be hazardous by the National Institute of Standards and Technology. Under current OSHA regulations, there is no expiration date associated with a MSDS. Materials **not** considered to require an MSDS, fall into one of the following categories:

1. The SRM is an article, as the word is defined in paragraph (c) of section 1910.1200 of the title 29 of the Code of Federal Regulations, which does not release or otherwise result in exposure to a hazardous chemical, under normal conditions and use.
2. The SRM has been determined to be non-hazardous by NIST under paragraph (d) of section 1910.1200 title 29 of the Code of Federal Regulations. The SRM will not release or otherwise result in exposure to a hazardous chemical under normal conditions of use.
3. The SRM is a pesticide or hazardous waste labeled according to regulations issued by the U.S. Environmental Protection Agency (EPA).
4. The SRM is a food, food additive, drug or clinical material labeled according to regulations issued by the Food and Drug Administration (FDA).
5. The SRM is a wine labeled according to regulations issued by the Bureau of Alcohol, Tobacco and Firearms (ATF).
6. The SRM is a tobacco product, wood or wood product which is exempted by paragraph (b)(5)(ii) and (iii) of section 1910.1200 of title 29 of the Code of Federal Regulations from the provisions of that section.
7. The SRM was obsoleted before MSDS regulations came into effect.

Additional information about MSDSs can be obtained by contacting the SRM MSDS Coordinator at:

Telephone: (301) 975-6439
Fax: (301) 926-4751
E-Mail: srmmsds@nist.gov

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59a	Ferrosilicon	Nov 93	41
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77a	Burnt Refractory (Al203-60%)	Sep 94	88
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2745	CO2/N2, 16 mol%	Jul 96	70
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